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Lluvia de Oro Hydro-electric Plant and Water System

By H. R. Conklin*

The Lluvia de Oro mill, Lluvia de Oro, Chihuahua, Mex., had been designed for electric power and a steam plant ready for machinery, consisting of water-tube boilers and a 500-kw. steam-turbine unit, had been built near the river about five miles from the mill. In August, 1909, all the equipment as originally designed was in place and running. The steam plant had a large amount of wood stored near-by, ready for use as fuel, but the difficulties of packing cord wood on mules and burros in sufficient quantity to operate the plant regularly were physically impossible to overcome, even if not financially prohibitive.

Hydro-electric Plant of Lluvia de Oro on Fuerte River, Chihuahua, Mex.

(The river, as shown in this view, is at flood stage. A box cañon downstream confines the river so that when flood stage reaches 25 ft. over the crest of dam, there is no distinct fall of water.)

Plant Completed in Eight Months

Concession for water power had been applied for, but the world moves slowly in Mexico, and it was not possible to begin any actual construction or even order machinery until October.

After running the steam plant for three months, all milling operations were suspended and sufficient fuel saved to enable the steam plant to furnish power for pumping during the construction of the hydro-electric plant. The latter was designed for 40-ft. head of water, requiring a stone-and-cement dam across the river, 150 ft. long on the crest, and using a vertical, upward-flow turbine, direct connected to a 400-kw. generator. The dynamo-room floor is 30 ft. above the crest of the dam, to avoid danger of flood as far as practicable. This entire plant was completed and power being supplied on June 1, 1910, eight months after commencing. As one month was consumed in preparation, and one month lost on account of a high rise in the river, six months covered the time of actual work.

The estimated power required to operate the works was 350 kw. and allowing for probable additional requirements, called for no smaller unit than 400 kw. The actual maximum requirement of power for water supply, mill operation, and sundry load, such as lighting and shops, is about 370 kw., so that when one electric furnace (used in melting concentrate and cyanide precipitate) is added, requiring about 45 kw., the hydro-electric plant has all the load it can possibly handle, and occasionally

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has to be relieved by stopping some motor temporarily. Often it is possible to run for several days with a power consumption enough smaller to permit of operating two electric furnaces, but as one furnace has melted up to 40,000 oz. of bullion in four days, and as a large accumulation of concentrate has now been smelted, a single furnace hereafter will easily reduce the entire product.

The cost of building a hydro-electric plant under the conditions existing at this site would not have been much larger for a 500-kw. unit than for one of 400 kw., but that additional cost has been saved, since the 400-kw. unit is just large enough by carefully adjusting the load. The regular cost of operation, aside from repairs and general supervision, consists of payroll and lubrication, and has not exceeded $250 per month.

Water Pumped from River

The mill was built near the mine, and no water is available there. This required pumping from the river sufficient water to operate the mill and supply the domestic requirements of the village. Five miles of pipe line were necessary and a 3400-ft. lift. A triplex plunger pump of 40 gal. per minute capacity, with 2¾-in. plungers and 12-in. stroke, designed for a pressure of 2600 lb. per sq.in., and gear driven by 75-hp. motor, was purchased. The pipe line was laid up a ridge so that three miles of 2½-in. XX pipe carried the line nearly to its final elevation; two miles of 2-in. merchants' pipe brings it to the mill. The pipe line is all in 8-ft. lengths, with steel flanges about 300 ft. apart and has given no trouble since laying. The line is exceedingly crooked, both horizontally and vertically, and the numerous bends prevent any trouble from expansion and contraction. No fittings are used, all turns being made with bent pipe. The grade is continually up, from the pump to the highest point, and then continually down toward the mill, except for one rising portion at the extreme end.

For safety during floods, the triplex pump is placed 70 ft. above the river, and a small centrifugal pump, direct connected to electric motor, all mounted in a car on inclined track, is used to supply its suction tank. No trouble has arisen in operating this water supply, except excessive wear of the valves during the rainy season, caused by the large amount of grit in the river water, which cannot be filtered satisfactorily. Pressure at the pump is close to 2000 lb. per sq.in., 500 lb. being due to friction head.

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Giroux Consolidated Report

Annual report of the Giroux Consolidated Mines Co., for the year ended Dec. 31, 1912, states that little drilling was done during the year at the Kimberly, Nev., property and consequently the ore reserves remain as in 1911. Bonded indebtedness also remains as in the previous year. No work was done at the Mexican properties.

A strike of the miners took place in October, the pumps were stopped and water was allowed to rise. The water is expected to stop short of the 1000-ft. level, which is somewhat above the permanent water level.

Shipments of concentrating ore were started in May, 1912, and production was gradually brought up to a minimum of 1200 tons per day. Total shipments for the year were: Concentrating ore, 140,877 tons; smelting ore, 410 tons.

August, September and December were the only months in which production came entirely from underground mining. Excluding extraordinary development and construction at the property, the cost of production of copper for these three months was 10.8c. per lb., or a net profit of $150,000 during that time.

Statement of the year-end shows assets of $715,073, and liabilities of $649,008, an excess of assets over liabilities of $66,065, the statement covering both the Nevada and Mexico properties.

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U. S. Foreign Metal Trade in 1912

The exports and imports of metals in the United States for the full year are given in the accompanying table, the figures being taken from the report of the Bureau of Foreign and Domestic Commerce of the Department of Commerce and Labor.

I. IMPORTS AND EXPORTS OF METALS

	Exports		Imports	
	1911	1912	1911	1912
Copper, long tons	363,493	357,423	149,333	183,143
Tin, long tons	1,010	390	47,740	51,787
Lead, short tons	101,787	64,906	89,952	83,560
Zinc, short tons	7,030	6,682	1,638	11,115
Zinc in ore, lb.	21,636,946	13,556,954	38,148,877	39,995,719
Nickel, lb.	25,099,586	25,815,016	29,545,967	42,168,769
Antimony, lb.	160,844	50,984	10,967,844	17,645,870
Aluminum, lb.	3,360	211,036	4,173,308	22,759,937
Platinum, oz.	181	.....	122,390	104,683

Copper, lead, nickel and antimony include the quantity of metal contained in ores, matte, bullion, etc. The quantity of antimony ore is not given. The exports include reëxports of foreign material.

Exports of manufactures of aluminum were made, which were valued at $1,158,603 in 1911, and $1,347,021 in 1912; quantities not given.

The imports and exports of metallic ores and of by-products are given in the second table:

II. IMPORTS AND EXPORTS OF ORES, ETC.

	Exports		Imports	
	1911	1912	1911	1912
Zinc oxide, lb.	29,236,779	34,128,163	.....	.....
Zinc dross, lb.	8,492,252	410,568	.....	.....
Zinc dust, lb.	.....	28,800	.....	563,180
Zinc ores, tons	16,322	20,847	57,933	55,522
Chrome ore, tons	5	.....	38,309	53,929

Imports of zinc dust were not stated separately prior to July 1, 1912, so that the statement above covers six months only.

Copper

Exports of copper to various countries in 1912 were as follows: Germany, 252,156,012 lb.; Holland, 152,618,177; France, 152,618,177; Belgium, 131,362,694; Great Britain, 95,422,292; Italy, 47,251,432; Canada, 30,302,856 lb. A considerable part of the exports to Holland are intended for Germany.

Some details of the imports of copper in 1912 are given in Table III, the figures being in pounds:

III. DETAILS OF COPPER IMPORTS

	In Ore and Matte	Metal	Total
Germany	1,217,055	.....	1,217,055
Great Britain	.....	1,404,118	1,404,118
Spain	5,487,584	31,670,095	37,157,679
Canada	28,930,073	36,138,255	65,068,328
Mexico	18,069,987	24,742,193	142,812,180
Cuba	10,288,680	.....	10,288,680
Chile	26,749,545	8,627,421	35,376,966
Peru	.....	43,891,439	43,891,439
Japan	.....	19,511,492	19,511,492
Australasia	.....	24,700,333	24,700,333

The greater part of the copper imported is brought here to be refined and put in marketable shape.

Nearly all the lead exported is foreign lead refined in this country.

Methods and Costs, Mother Lode Mine, B. C.

By E. Hibbert*

SYNOPSIS—Gloryhole, shrinkage and spiral-raise systems abandoned for room-and-pillar method. Inclines run from a foot-wall raise and benches broken out. Pillars broken down by mammoth blasts. Electric firing used, wiring being done with great care. A cause of misfires discovered to be unbalanced circuits. Low costs obtained. Under suitable conditions, system offers great advantages, especially safety for miners.

The system of mining at the Mother Lode mine of the British Columbia Copper Co., Ltd., presents some new and interesting features. The orebody is an altered limestone carrying enough gold, silver and copper to constitute a low-grade ore that is also self-fluxing. It is large, 160 ft. wide on an average, but with a maximum width of 260 ft. The hanging wall is also an altered limestone but carries practically no mineral; from the surface to the 200-ft. level the dip is about 70°. Two porphyry (pulaskite) dikes cut the orebody, a small one close to the surface and a large one at the 200-ft. level.

Old Systems Found Unsatisfactory

From the 60-ft. level to the surface most of the ore was removed by the glory-hole system, although in places some stoping by the shrinkage system was done, either the sill floor being removed and square-sets placed, or the ore on the sill floor left in position and chute raises run through the solid ore to the stope. This method proved unsatisfactory, owing to the great area of roof exposed; so that on blasting, large pieces would rip off, causing considerable danger to the men and trouble with the broken ore.

The next system of mining tried consisted of putting in a series of spiral raises, the idea being that solid pillars would be left on the inside of the spirals to support the workings. In practice each raise, instead of being a screw-thread spiral presented somewhat the appearance of a screw-thread stripped from the screw and partly unraveled. When it is realized that such a raise and pillar is a three-dimensioned object, the difficulty of representing a mass of them on paper may be imagined; in fact the mining difficulties became insuperable and the mine was being cut up with a series of uncoördinated twisted raises with branches and connections. Another disadvantage of the system was that all the underground work was done out of the solid and no advantage was taken of previous workings as free faces for breaking to. P. S. Couldrey, on taking charge of operations, abandoned the system described and by straightening out the raises, and then breaking down the bench between the inclines, making one incline or raise pass vertically over another one, mined part of the orebody at low cost.

On succeeding Mr. Couldrey, I developed the latter's idea into what can best be described as a pillar-and-chamber system of mining. An ideal, longitudinal, vertical section of the mine between levels with both the chambers and the pillars in various stages of excavation, is shown in Fig. 1, of the illustrations.

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Inclines Run from Foot-wall Raises

The preliminary opening up of both pillars and chambers is not dissimilar. A foot-wall raise, shown in Fig. 2, is run, or an old working used as a raise. This is not straight, but usually a series of spirals, each spiral being made from one incline to that above by partly cutting through the pillars on each side of the incline to make the turn. From this, inclines are driven to the hanging wall at an angle of 36°-52°, the slope of the ordinary 3:4:5 right triangle. Then in the case of the chambers, the benches or ribs between the inclines are broken down, a cheap operation, as the ore is bound on three sides only, or, in the case of a first cut on a bench of double thickness, such as those in the pillars, on four sides only. An incline is prepared for benching by mucking off from top to bottom and blowing off the last of the loose dirt with air, in order that a careful search for missed or partially missed holes may be made, partially missed holes being particularly liable to occur when smooth slips are present in the orebody, and run with the incline, but

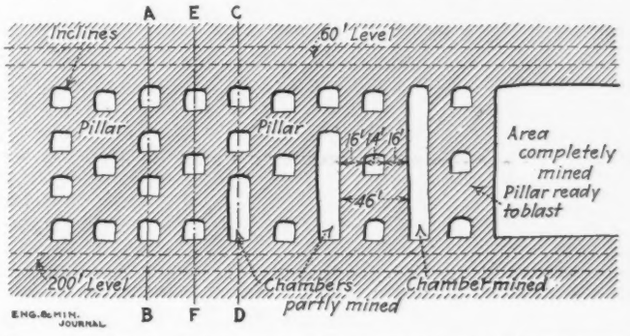


Fig. 1. Ideal Longitudinal Section of Developed Orebody Showing Alternating Pillars and Chambers

at a slightly greater angle than it. Mining the benches is comparatively safe as the men are close to the back and can easily bar down loose ground. Since a man, rolling from the top of a bench, might drop 100 ft. or more, it is necessary to anchor both men and tripods by ropes.

The slope of 36° 52′ has proved the best for getting rid of the broken ore without mucking and still maintaining the incline as flat as possible for ease and cheapness in driving. To ascertain the right slope for any given orebody, will require some experimenting. In driving the incline, if the slope is too great, all the broken ore will run down, leaving the bare rock showing on the bottom, and if the slope is too small, the incline will fill up with the broken ore.

In the pillars, the benches are not broken down, and fewer inclines require to be run, since the thicker benches then left can be drilled out from the inclines above and below the bench, as exhibited in Fig. 4, a transverse section through a pillar.

Pillars Mined by Mammoth Blasts

Mining the pillars constitutes one of the interesting points of the system. From the inside, the pillar is drilled out from top to bottom, holes being put in tops,

sides and bottoms of the inclines. The standard length of a hole is 14 ft., although in places where such long steel cannot be changed, shorter holes are put in, and in other cases, where necessary, 16-ft. holes are drilled. The pillars at the end of the mine farthest from the shaft are first drilled and an effort is made always to have several pillars drilled out ready for blasting.

A large porphyry dike, 20 ft. thick, cuts through the orebody at the 200-ft. level, the dip of the dike being toward the foot wall of the orebody at approximately the same angle as the inclines. The inclines are run above the dike and, so far, all pillars have been blasted from the dike to the surface, the dike being left intact so far as possible, in order that it may form a roof for the workings under the 200-ft. level.

Elaborate Wiring System for Electric Firing

In blasting the pillars, 40% dynamite is used and all the holes in a pillar are loaded and then fired by means of electricity. In the first big blast, of October, 1911, the method used was similar to subsequent blasts, and may be described as typical. Loading started on Monday morning, Oct. 2, at 7 a.m., and continued until Wednesday morning, Oct. 4, at 1 a.m, All the machine men were employed loading the holes under the supervision of the foreman and shiftbosses. The detonators were given to specially selected men, whose sole duty during the loading was to make up the primers and hand them to the loaders, seeing that the wires of the detonators were carefully unwound and free from kinks. The electrician commenced stringing lead wires on Tuesday morning, Oct. 3, and when this was finished he started wiring up the most distant sections, connecting all holes in series of 25 to the lead wires. At 1 a.m. Wednesday morning, a special wiring crew, consisting of the superintendent, foreman, shiftbosses and a few picked men was put on under the charge of the electrician and the wiring completed. The blast was exploded at 10:30 a.m. Wednesday morning, Oct. 4, and broke 175,000 tons of ore.

In this blast 2433 holes were loaded with 425 boxes, or 10⅝ tons of 40% dynamite. The holes were connected to the lead wires in series of 25, using 2525 Nobel's No. 7 low-tension detonators with 8-ft. lead wires, the extra detonators being used to make up the series of 25 detonators in a circuit in places where the holes could not easily be connected up to the lead wires in series of 25. When everything was ready for the blast, the main lead wires were connected to a 550-volt, alternating-current circuit. The main lead wires from the transformers were of No. 1, rubber-covered copper wire, and from these No. 6 and No. 8 weather-proofed copper wires led off. No. 10 and No. 12 weather-proofed copper wires again led from the No. 6 and No. 8 wires for the shorter circuits. All joints on the leads were covered with friction tape.

A Safety Margin Obtained by Using High Voltage

The No. 7 low-tension detonators with 8-ft. lead wires have a resistance of one ohm and require ½ amp. for detonation. In the blast described, there were 101 circuits with 25 holes in series in each circuit, and as a current of ½ amp. was required in each circuit, a current of 101 × 0.5, or 50.5 amp., was required in the main lead wires, figuring no losses. Had connection been made to the 110-volt lighting system, the total resistance of the leads and detonators would require to be under 110 ÷ 50.5, or 2.2 ohm. With the wiring used this did not leave enough margin for safety, figuring on poor joints, etc., and so connection was made to the 550-volt circuit, especially as no instance had been noted at this mine where excess of power caused any trouble with complete detonation. As a matter of fact, in making the calculations for the voltage required, the amperage and resistance of the detonator were figured as one ampere and one ohm respectively.

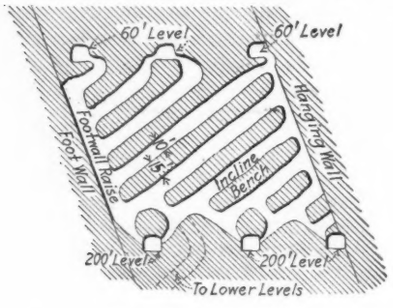


Fig. 2. Fully Developed Chamber, Ready for Breaking Out Benches. Section A-B

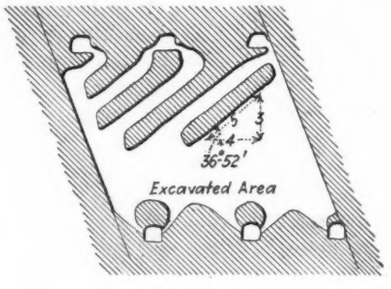


Fig. 3. Chamber Partly Mined. Section C-D

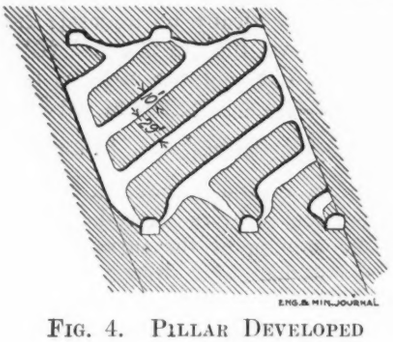


Fig. 4. Pillar Developed Ready for Drilling and Blasting. Section E-F

Freezing of Dynamite

Owing to the time of year when the large blasts have been made, most of the dynamite probably freezes in the hole before the wiring is completed. In a large blast in April, 1912, this was certainly the case, as previous to loading, the holes were full of ice and a steam pipe had to be run into the mine and the holes blown out with steam. In spite of this, very little dynamite is found in the broken ore, it being estimated that only one-quarter to one-half of the dynamite met with in the broken ore from ordinary incline and bench work is met with in the broken ore from a large electrical blast. This may be due to the large detonators, No. 7, used in the blast and some sympathetic detonation, or detonation caused through the explosion in adjacent holes, may also take place.

A curious effect of a large blast set off in this manner is the small disturbance produced; adjacent ground is only slightly affected and persons a short distance away from the mine are unaware that anything out of the ordinary is taking place. This is probably because all the various parts of the section of the orebody are shattered at the same time, and the disturbance caused by the explosion in the center of the orebody meets with broken

ground before it reaches the walls and is neutralized, and consequently the only effect produced on the walls is caused by the explosion in the holes immediately adjacent to them.

Care Necessary in Balancing Circuits

In connection with electrical blasting, care must be taken that the resistances in the various circuits are well balanced, so that all the detonators will explode at the same time. The best way to insure this is to use large lead wires and to take care that the same number of detonators are connected up in each series. This was brought to our attention in a rather forcible manner. On one occasion a small blast had to be exploded and the electrician did the wiring for it. He had been instructed to see that all detonators were connected up in even series, but on this occasion there were 101 holes to be connected, and he took the chance of making three series of 25 holes and one series of 26 holes, the last series being nearest to the main leads. After the blast, it was noticed that the three series of 25 holes had exploded, but the series of 26 holes had failed to explode; fortunately the unexploded holes were easy to rewire. It was considered possible that if the speed at which the fuse wires in the detonators reach the detonating temperature was less than the speed of explosion, then, given suitable conditions, the explosion from the series of 25, could break the lead wires of the series of 26 before the fuse wires in these detonators had reached the detonating temperature, and so cause the failure to explode.

TABLE I. COSTS DISTRIBUTED ACCORDING TO OPERATIONS

Total shipments	377,510 tons.	
Mining:	Cost per Ton	
Mining and timbering (labor)		$0.1380
General underground and tramming (labor)		0.0956
Explosives		0.0997
Candles		0.0046
Drill parts and hand tools		0.0210
Shops (except drill parts and hand tools)		0.0063
Compressor and power		0.0269
Lumber		0.0028
Sundries		0.0158
Total		$0.4107
Hoisting:		
Labor		0.0339
Shops and sundries		0.0099
Compressor and power		0.0135
Total		$0.0573
Crushing, conveying and storage:		
Labor		0.0161
Shops and sundries		0.0160
Compressor and power		0.0033
Total		$0.0354
Surface expenses:		
Labor and staff salary		0.0244
Insurance and taxes		0.0227
Shops and sundries		0.0121
Boilers		0.0101
Total		$0.0693
Total, f.o.b. railway cars at mine		$0.5727

TABLE II. CERTAIN ITEMS SUBDIVIDED INTO LABOR AND SUPPLIES

Operation	Cost per Ton Labor	Supplies	Total
Tramming	$0.0556	$0.0071	$0.0627
General underground	0.0400	0.0044	0.0444
Machine shop	0.0124	0.0012	0.0136
Blacksmith shop	0.0154	0.0019	0.0173
Carpenter shop	0.0036	0.0002	0.0038
All shops	0.0314	0.0033	0.0347

TABLE III. MONTHLY TONNAGES AND COSTS

Month	Cost per Ton	Tons Shipped
December 1911	$0.6636	24,875
January 1912	0.5973	35,550
February 1912	0.5652	32,398
March 1912	0.5407	35,192
April 1912	0.6748	28,477
May 1912	0.6816	29,228
June 1912	0.5417	30,039
July 1912	0.5543	30,959
August 1912	0.5019	34,316
September 1912	0.5655	31,623
October 1912	0.5343	32,735
November 1912	0.4848	32,118
Average	$0.5727	Total 377,510

Unbalanced Circuits Cause Misfires

Some experiments were made to test out this idea. Two detonators *BB*, Fig. 5, were wired in series and one lead wire *C* was wound round a single detonator *A*. The detonators were then connected to batteries, as shown in the sketch. The single detonator *A* exploded, broke the lead wire *C*, and the detonators *BB* failed to explode. This showed that with the current employed the speed of explosion of a detonator was greater than the speed of heating up the fuse wire in a detonator. Similar results were obtained by connecting up in this manner series of two and three, and series of three and four detonators. It is possible that the failure of the 26 holes to explode may have been due to some other cause, but the experiment showed clearly the necessity for having well balanced circuits with the same number of detonators in series in each circuit.

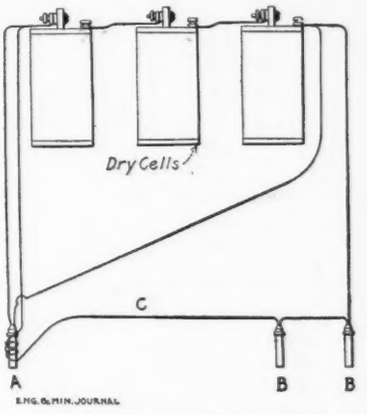


FIG. 5. ARRANGEMENT FOR TESTING UNBALANCED DETONATOR CIRCUIT

Low Costs Obtained

The system of mining described here represents the ideal that has been kept in view, but owing to the existence of old workings, it has been considerably modified to suit the conditions. The average costs per ton for the 12 months ending Nov. 30, 1912, using the system described, are here given, in Tables I and II.

The cost per ton for explosives in a large blast is small, but on account of the old workings it has not been possible to thoroughly drill out all parts of a section, and consequently some of the broken ore from a large blast is caved ground, which has to be bulldozed in the chutes and block-holed and broken up in the inclines leading to the lower levels. It is in this work that most of the explosives are used. Air from electrically driven compressors is used for hoisting, skips holding four tons and dumping automatically, being employed. There are boilers at the mine, but they are used only for heating purposes. The machine drills used are Sullivan 3¼-in. piston and No. 2 Murphy.

Requirements and Advantages of the System

For the successful operation of this method of mining, it is considered necessary to have a large, fairly uni-

form orebody of too low a grade to permit the use of any filling or timbering method for supporting the excavations made during its extraction. The ore and walls must be good holding ground, and the foot wall dip at an angle greater than 36°. These requirements limit the application of this system of mining, but as adopted at the Mother Lode mine, because of the fact that the roof is exposed in small areas and the miner is always close to the back, it has proved itself a safe method of mining. The low costs are due to the following causes:

(1) Practical absence of mucking.

(2) Timbering required in chutes only.

(3) Increased drilling capacity per machine when drilling out pillars, as the machine has not to be torn down and stowed away every day for blasting, but keeps drilling all the time; the footage drilled per machine shift, using 3¼-in. machines, has risen from 22 to 23 ft. to 31 or 32 ft. since this system was adopted.

(4) The exposure of free faces by driving inclines which renders the remaining ore easier to break.

TABLE IV. WAGES AND HOURS OF EMPLOYMENT

Occupation	Hours	Wages per Day: Dec. 1, 1911 to July 31, 1912	Wages per Day: Aug. 1, 1912 to Nov. 30, 1912
Miners sinking	8	$4.00	$4.25
Machinemen	8	3.50	3.75
Bar men	8	3.75	4.00
Muckers	8	3.00	3.25
Nippers	8	3.25	3.50
Chute men	8	3.25	3.50
Timbermen	8	3.50	3.75
Blasters	8	4.00	4.25
Blacksmiths	9	4.00	4.25
Blacksmith helpers	9	3.25	3.50
Skip tenders	8	3.50	3.75
Laborers	9	3.00	3.25
Carpenters	9	4.00	4.25
Compressor engineer	8	4.00	4.25
Machinists	9	4.00	4.25
Motormen	8	3.50	3.75
Hoist men, double drum	8	4.00	4.25
Hoist men, single drum	8	3.50	3.75
Crusher men	9	3.50	3.75
Crusher helpers	9	3.00	3.25
Pipemen	8	3.50	3.75
Trackmen	8	3.50	3.75
Watchmen	12	3.00	3.25

TABLE V. COMPOSITION OF AN AVERAGE CREW

Underground	Surface
1 Foreman	1 Superintendent
23 Machinemen, piston	1 Master mechanic
13 Machinemen, hammer	2 Skip hoist men
3 Timbermen	2 Cage hoist men
2 Blasters	3 Compressor engineers
1 Powder man	4 Blacksmiths
6 Motormen	2 Machinists
12 Chute men	1 Carpenter
1 Bar man	4 Crusher and conveyor men
1 Nipper	1 Railway car loader
1 Pipe- and track-man	1 Electrician
4 Skip loaders	1 Watchman
2 Cage tenders	1 Barnboss
4 Shiftbosses	1 General surface man
	2 Office and warehouse men
	8 Boarding house employees
74 Total	35 Total

By examining Fig. 1, it can be seen that a modification of the system of mining described would be to dispense with the excavation of the chambers, the procedure then being to blast one solid pillar and the benches in the adjacent cut.

Aluminum Vanadium Alloys

Aluminum-vanadium alloys have been investigated by Nicolas Czako, according to the *Journal du Four Electrique,* Feb. 1, 1913. Up to 10% V, the alloys are malleable; from 20 to 25% V they can be pulverized in a mortar. From there to 53% V, they are full of cavities, so that it is hard to obtain a polished surface. The hardness increases with increase of vanadium until the composition AlV is reached, and again to the point 53% V, at which the hardness is between 6 and 7. From 60 to 80% they become less hard and are free from blow-holes.

Ammonia from Aluminum Nitride, Serpek Process

The general outlines of the Serpek process for the manufacture of aluminum have been noted several times in the JOURNAL, but the full treatment of the aluminum nitride to give alumina, as given in U. S. pat. 1,040,439, seems of interest. In this, Serpek states that nitride of aluminum is a body fairly resistant to water. At ordinary temperatures it decomposes, giving off ammonia in a manner hardly perceptible, and it is only in boiling water that the evolution of ammonia begins to be appreciable. But even under pressure, and consequently at temperatures higher than 100° C., it requires a long time to obtain a large yield of ammonia. It has already been proposed to obtain ammonia by means of aluminum nitride by decomposing the latter by solutions of alkaline aluminates.

The present invention is based upon the following observation, that it is possible to work with solutions of aluminate, in which the content of alkali is less than that which is necessary to render soluble the alumina resulting from the decomposition of the aluminum nitride treated. Consequently, it is possible to employ over and over the weak alkaline lyes resulting from the preceding operation, so as to be able to suppress in this way the loss of alkali and the expense necessitated by the concentration of the weak solution. The process can be applied to all nitrides which can be decomposed by alkali, and of which the decomposition yields saline solutions in a dissociated state; for instance, to the decomposition of any nitrogenous compounds by solutions of alkaline silicates.

For example, if 100 kg. of aluminum nitride with a content of 28% of nitrogen, that is, of 82% of pure aluminum nitride, are introduced into 200 kg. of a solution of aluminate containing 20% of potassium hydrate, and the whole brought to boiling point with continual stirring, ammonia is given off in a strong and regular manner, and after boiling there remains precipitated alumina which contains practically no nitrogen. It is preferable to effect the boiling under pressure.

Theoretically, the quantity of nitride mentioned should necessitate 100 kg. of alkali. In practice, 40 kg. of potassium hydrate are sufficient, which is not employed in the free state, but in the form of a salt. After complete decomposition and the separation of the solution of precipitated alumina, and if necessary after dilution of the solution with water up to 200 kg., this solution can serve again to decompose another 100 kg. of nitride. In the same way the alumina separated from the solution can be treated so as to reform nitride.

Speaking generally, if small quantities, or even merely traces of alkali, are added to an aqueous solution in the presence of aluminum nitride, the decomposition of the latter is made in a complete manner as with water alone, but much more rapidly. The alkali, whether free or in the form of aluminate, attacks the nitride with disengagement of NH_3, and precipitation of Al_2O_3 coming from the nitride to be decomposed.

Refining at Pittsburgh-Silver Peak Mill

By Lyon Smith*

SYNOPSIS—The cyanide precipitate is acid treated, washed, fluxed, briquetted and charged to a blast furnace. The lead bullion produced is cupelled and the resulting gold bullion remelted with borax in a tilting furnace, the final product averaging 980 fine.

The cyanide precipitate produced at the plant of the Pittsburgh-Silver Peak Mining Co., Blair, Nev., is acid treated, washed, fluxed and briquetted, after which it is reduced to lead bullion in a blast furnace. This is cupelled and the resultant gold bullion remelted with borax in a tilting furnace, the final product averaging 980 total fineness. The detail of operations, as outlined below, has been compiled from normal cleanups and represents a fair average of conditions and results.

Precipitate Acid Treated

Precipitation is by the zinc-dust method, using the usual Merrill equipment. One 30-frame, 52-in. press, having a filtering area of 420 sq.ft., and storage capacity of 35 cu.ft., is used to precipitate all solution, 750 tons per day being the average amount precipitated. The press is cleaned three times per month and yields at each cleanup from 800 to 1000 lb. of product, wet weight, as removed from the press. The precipitate, as cleaned from the frames, drops into a lead-lined car, mounted upon suitable rollers, and is transferred directly to a lead-lined acid-treating tank, 6 ft. in diameter and 5 ft. deep, the charging floor of which is on the same level as the press foundation.

The tank is provided with a mechanical agitator, consisting of two wooden paddles mounted on a central shaft and driven by bevel gears from below. Sulphuric acid of 66° Bé. is used, in amounts varying from three-quarters to one and one-quarter parts to one of dry precipitate. From three to five hours is required for treatment, after which the mixture passes through a 2-in. line to an 18-frame Shriver press, on the main floor of the refinery. The frames are 28 in. square. The filtering medium is a light drilling over which is placed a 6-oz. canvas. The 2-in. line is provided with a monteju.

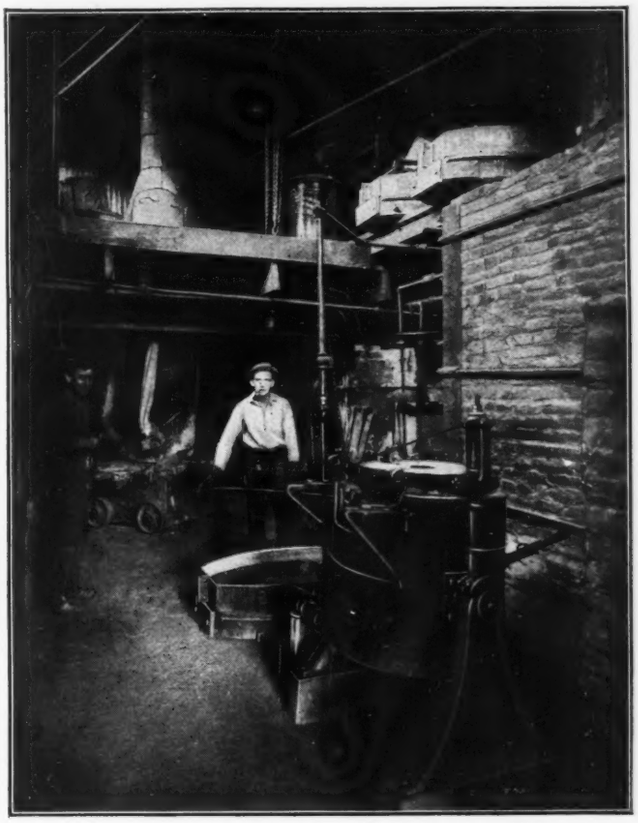
From five to eight separate washes of hot water are given the precipitate in the press. This water is heated in an oil-fired vertical boiler, from which it is passed through the press by displacement. The effluent solution, averaging from 25 to 50c. per ton, is settled in a 6x6-ft. wooden tank, the overflow from which passes to a zinc box packed with excelsior and thence to waste.

The life of the original frames furnished with the Shriver press was three years, at the end of which time they were discarded. The corrosive action on the bearings and other parts exposed to the acid rendered the frames useless. Upon the installation of a second set, the practice of painting the frames every six weeks or two months, with a coating of black asphaltum varnish, was adopted, with the result that after two years' service the frame bodies and bearings have not been affected in the least by the acid.

*Mining engineer, Blair, Nev.

Precipitate Dried, Fluxed and Briquetted

Following the final wash water, air under a pressure of five pounds is passed through the press, the precipitate containing 38% moisture when discharged and transferred to the drier. This is an all-iron container, 11 ft. long, 6 ft. wide and 26 in. deep, provided with a false bottom 14 in. from the top, the inclosed space acting as a steam chamber. The precipitate is dried sufficiently to screen and sample, after which it is weighed on adjacent platform scales and spread evenly over the drier surface for the addition of fluxes, which are added in



Refining Department of Pittsburgh-Silver Peak Mill

the following proportion: Dry precipitate, 100 parts; litharge, 125; borax, 25; soda, 15; coke, 4. The mixture is turned several times with a shovel, and is then briquetted at a pressure of about 1000 lb. per sq.in. The briquettes, cylindrical in shape and weighing slightly less than one pound each, are returned to the drier and subjected to a slow heat.

The blast furnace, which is operated once a month, is of the cylindrical type with suspended jacket and a removable curb mounted on wheels. The diameter at the tuyere line is 22 in. and the height of jacket 5 ft. 10 in. The blowing in of the furnace requires from two to three hours, and presents no departure from the usual practice. After several blank charges of coke have been fed, 200 lb. of pig lead are added to fill the crucible and float the ash, the siphon in the meantime being kept closed.

When the crucible has been filled with the molten lead, the ashes are removed and the siphon opened, following which charges of coke and slag are added until the furnace is slightly more than half full.

Briquettes Charged to Blast Furnace

The furnace charge is now added, four such additions per hour being the normal charging rate. The regular furnace charge is as follows: Briquettes, 100 lb.; slag, 30 lb.; cupel bottom, 7 lb.; furnace crust, 7 lb.; coke, 30 lb.; total, 174 lb. The following outline, taken from the records, gives a good idea of the furnace operation and results obtained. Blowing in, 3 hr.; total time consumed, 18 hr.; number of charges, 64; lead recovered, 1780 lb.; matte recovered, 257 lb.; slag recovered, 3500 lb.; crust recovered, 360 lb.; coke used, 2500 lb. The lead bullion is dipped from the lead well and cast into bars weighing approximately 27 lb. each.

The cupellation of the lead bullion is carried on in a single English cupellation furnace of usual pattern, using crude oil as a fuel. The furnace is provided with a removable test, and the cupel is made by thoroughly mixing 450 lb. of portland cement with 150 lb. of limestone of from 20- to 30-mesh size. The mixture is rendered plastic by the addition of water, 14% of the total weight being used. The cupel, 2 ft. 10 in. long by 2 ft. wide and 6½ in. deep, is seasoned for one month previous to use and lasts for one run. Air for the blast and cupellation furnaces is furnished by a Connersville blower operating at 230 r.p.m., and displacing 3¼ cu.ft. of air per revolution. A blast of from three to five ounces per square inch is used on both furnaces.

The table given below supplements that given under blast-furnace details and has been compiled from the record of cupellation of the lead bullion obtained in that particular run.

RUN OF LEAD CUPELLATION FURNACE

Furnace fired	10.00 p.m. 4th.
Melt started	10.00 a.m. 5th.
First lead drawn off	3.00 p.m. 5th.
Last lead drawn off	9.00 a.m. 6th.
Poured	10.30 a.m. 6th.
Total lead cupelled	1780 lb.
Time consumed	18 hr.
Rate of cupellation	981 lb. per hr.

It should be explained that the cupellation furnace has only recently been equipped with an oil burner, and that the above data were taken when wood was used as a fuel. The use of oil effects a saving of from 30 to 40% in fuel cost and reduces the attendant labor required one-half. A marked increase in the rate of cupellation is also noted.

Donaldson Furnace for Refining

The bullion obtained is melted in a No. 60 Donaldson oil-fired tilting furnace, using borax as a flux and yields a final bullion averaging 665 parts fine in gold and 315 in silver. This is shipped to the Selby Smelting & Lead Co. for further refining.

The matte obtained from the blast furnace is fluxed with litharge, borax, soda and coke and is treated in a separate run in the tilting furnace. A scavenger run in the blast furnace is made every month or two for the cleanup of accumulated byproducts and residues. The cost of precipitation and refining is $.080 per ton of ore treated, $0.035 being charged to precipitation and $0.045 to refining. These figures are based on the milling of 15,000 tons of ore per month.

Bauxite near Elizabethtown, Tenn

By Joel H. Watkins*

The development by the National Bauxite Co. of its new mine, near Keenburg, Carter County, Tenn., brings to light a new bauxite area which is at least 200 miles north of any bauxite mine which has yet been operated. The mine, which was opened in June, 1912, is situated about one mile northeast of Keenburg, a station on the Virginia & Southwestern R.R., and about four miles due north of Elizabethtown, the county seat of Carter County. The underlying rocks in this area are composed of Cambrian and Ordivician sediments, including the Athens shale, Knox dolomite, Honaker limestone, Erwin quartzite, Shady limestone and the Nolichucky shale, all of which have been extremely folded, besides being displaced by one major and three minor faults.

Bauxite Opencut Workings, Elizabethtown, Tenn.

General View of Incline

The orebody here, like those of the Georgia-Alabama area, is in the form of a large, irregular, deep pocket, inclosed in the residual from decomposed Knox dolomite and associated with decomposed chert, kaolin and halloysite. The elevation of the mine is about 2000 ft. above sea level, whereas those of the Georgia-Alabama district are all close to 900 ft. above sea level. The ore is chiefly of the massive pisolitic variety and of fair grade, an analysis of the ore (which was furnished by H. E. Graves,

*Geologist, Southern Ry. Co., Washington, D. C.

of Bristol, Tenn.), being as follows: Insol., 18.38%; Fe_2O_3, 4.13; Al_2O_3, 49.90; H_2O, 27.59 per cent.

Since mining began at this point, about 50 cars of ore have been shipped and there is now a large storage of ore ready to be moved. The ore is lowered from the crest of the knob, where it is mined, by means of an incline about 1000 ft. in length, the loaded cars drawing the empties up. From the foot of the incline, where ample storage bins have been erected, a macadamized road has been completed, over which the ore is hauled in wagons a distance of about three-quarters of a mile to the railroad, where a small drying plant has just been constructed.

Owing to the fact that the geologic horizons and structural features in this new area are almost identical with those of the Georgia-Alabama district, it would seem reasonable to believe that systematic prospecting, both northeast and southwest of Keenburg, will reveal other workable deposits of bauxite, and bring this new field into greater prominence.

Copper Smelting at Bogoslowsk, Russia*

The copper-smelting works of the Société Minière de Bogoslowsk has been working spasmodically for the last 150 years, but it is only of late years that modern copper practice has been in vogue, although this was one of the first works in the Eastern Hemisphere to adopt the bessemerizing of copper mattes, the plant dating back to 1885. The works treats the ores produced from seven of the mines of the Bogoslowsk property, situated near the eastern slope of the Ural Mountains, its center being about 60° N lat. and 60° E long.

Nature of the Ores

The ores consist of chalcopyrite, chalcocite, erubescite, pyrrhotite, some cuprite, malachite and chrysocolla, accompanying a gangue, locally known as augite-garnet, together with some calcite and a little free silica. The average yearly tonnage is about 78,000, of which about 40,000 tons comes from the Bogoslowsky mine with the following proximate analysis: SiO_2, 27%; Al_2O_3, 12; Fe, 24; Cu, 6; G (S?), 16; CaO and MgO, 9.5%. The other ores range in copper content from 1 to 12%, silica from 13 to 41%, iron from 17 to 50%, combined lime and magnesia, 4 to 23%. The ore from one of the mines is a magnetite but only 1500 tons were produced during the year under consideration.

The ores before leaving the mines are hand-picked, the poorer ores being reserved for future concentration; ordinary water concentration is out of the question, as the specific gravity of the gangue is almost the same as that of the chalcopyrite; satisfactory results, however, have been obtained on a trial parcel by the Murex magnetic process.

The ores arrive at the works by rail, in side-tipping cars of 10 tons capacity, the double line passing over a series of stalls each of 500 tons capacity; the ores are spread in layers together with the byproducts from works. The finest ores are sintered in roasting pots, together with flue dust and other fine materials, the sintered product being hard and honeycombed.

*Abstract of a paper by Richard Davey in Bull. 101, I. M. M.

Mechanical Charging

The smelting mixture is shoveled into small side-tipping cars of two tons capacity and run along a tramroad to the charging floor, where it is tipped into the furnace—six cars (three on each side) constituting a charge, the coke being spread over the top of the charge after it has been leveled.

The top of the furnace is kept cold; a hot top increases the consumption of coke and the production of flue dust, which, although 30% of the charge is fines (less than ½ in.), is less than 2% on the total burden; and in winter, when the charge is frozen, less than 1½%. It is interesting to note that flue dust and fine coke are handled during the winter by preliminary freezing. The coke fines are mixed in a pug mill with a little tar from the company's charcoal ovens.

The smelting mixture is composed as follows: Raw ore, 75%; sintered ore and sintered flue dust, 5; sweepings, 1; calcite (1% Cu), 2.6; furnace products, 5; bessemer products, 11.4%. The average coke used amounts to 7% on the gross charge—the sulphur on the charge is 10% of which about two-thirds is available as fuel. As soon as a smelting mixture is completed a sulphur assay is made, and the coke charge is regulated according to the result.

The coke used during the last 12 months was English, and reached the works in excellent condition in spite of frequent handlings in transport; after lying all the winter, the quality deteriorated. The price delivered at works is £2 14s. per long ton.

One 42x210-in. Blast Furnace Used

There are two water-jacket furnaces, one 42x210 in., the other 36x84 in.; the former has a smelting capacity of 500 tons per day, the latter 200 tons. The larger is almost exclusively used, as being more economical. This furnace was entirely constructed at the works. There are thirty 3-in. tuyeres (15 on each side), and the height from tuyeres to charging floor is 14 ft. 3 in. The furnace is provided with two forehearths; these are brick lined, the inner lining being of magnesite brick with an extra-thick magnesite slab at the taphole. These forehearths are used alternately; by using a small proportion of old scrap ground magnesite brick with the stopping clay, the tapping hole will last several weeks and it is rarely necessary to revert to the second forehearth. The slag and matte spout is made of fine copper with water circulation; if air is allowed to circulate freely around it, this spout will last for several months. A small catchpot, holding about three tons of slag, receives the overflow slag from the main forehearth and collects any matte which it may have carried over; a small quantity of matte is tapped every two or three days from this catchpot; a second pot is from time to time placed in tandem style to receive the overflow before the slag runs into the granulating pit, from which it is taken up by a bucket elevator; as the buckets pass over the drum they empty themselves into a hopper which spreads the fine granulated slag over a railway truck. The railway is paid 1d. per ton to remove the slag either for ballast or to a dump heap. The composition of the slag is as follows: SiO_2, 38.63%; Al_2O_3, 12; FeO, 34; Cu, 0.28; S, 0.30; CaO, 12.82; MgO, 1.48; total, 99.51 per cent.

Converting in Small Acid-lined Shells

The matte, containing from 30% to 40% copper, is tapped into cast-iron ladles and taken by a 25-ton electric crane to acid-lined converters; as these are of only two tons capacity, the ladles are restricted to the same capacity.

The converting plant is quite out of date and consists of modified Manhès converters, the tilting being performed by hand; a modern plant is now being installed. For reasons which will be given later the converters will be of the ordinary 4- to 6-ton type, although under other circumstances the large basic converter now in vogue might have been preferred.

The liquid slag from the converters is not required for fluxing purposes and is poured into the blast-furnace forehearth in such a manner that the stream of liquid slag meets that of the slag and matte from the furnace as it overflows into the forehearth. When, two years ago, this method was started, the dump slag was found to be richer in copper than previously, due to a little rich converter matter going over; this was confirmed when we introduced the small settling pot, the matte which settled there being considerably higher in copper than the matte tapped from the main forehearth.

The average copper produced from the Bogoslowsk ores contains only about £3 worth of gold and silver per ton, but, on account of its exceptionally high quality, it has been marketed as B.S. ingot copper; however, circumstances have arisen in the Russian markets which make it desirable to cast a certain proportion of the production into anodes. So as to obtain a return from the precious metals, concentration of the gold and silver in the anodes is attained by blowing several ladles of matte and as soon as copper is noticed on the punching rods, the supernatant white metal is poured off and transferred to an adjoining converter, to be blown into blister for ingot copper; the copper bottom, containing practically the whole of the gold and most of the silver in the original matte, is cast into anodes. With a little practice it is easy to make bottoms representing the desired proportion of the total output of copper. With one large basic converter, it would not be possible to carry out this concentration of precious metals, nor would the present blowing power give sufficient pressure to work converters beyond four to six tons capacity.

The power plant consists of a 500-hp. de Laval steam turbine working at 14,000 r.p.m., under a dry-steam pressure of 150 lb.; as reserve, there is an engine of 100 hp. and two water turbines, giving together 250 hp. An independent 250-hp. blowing engine (for bessemerizing) giving 5000 cu.ft. of air per min., at a pressure of 7½ lb., is supplemented by an engine of 170 hp. worked by water power. Water power is available all the year round. The blast for the furnaces is obtained from Roots blowers, one giving 100 cu.ft. per revolution (200 r.p.m.), the other 35 cu.ft. per revolution. Each blower is worked from its own motor, delivering air at 24-oz. pressure to the furnaces.

Geological Map of Illinois

The Illinois Geological Survey has published a provisional geological map of the state. The areal geology is shown as it probably occurs, underlying the drift. Some of the formation boundaries are necessarily still indefinite. Three geological columns are shown for the northern, central and southern portions, and two east-and-west sections across the state. The areal map is complete in showing railroads, towns, water, etc. Relief is indicated by figures of elevation at certain points, no contours being attempted. The zinc, fluorspar and coal mines are indicated, and the oil and gas fields. A brief geological history of the state is printed in the margin. The map is an excellent example of the work of this enterprising state survey. The advantage of prompt, provisional maps such as this, subject to revision when more data are accumulated, should be more generally recognized.

Ground Sluicing Frozen Muck

The Granville Mining Co., operating on Dominion and Quartz Creeks in Yukon territory, is developing ground sluicing on an extensive scale as a practicable method of removing the overburden from the gold-bearing gravels and thus avoiding the expenses attendant on artificial thawing.

The tundra is first plowed, burned and opened up, says Henry Mace Payne in a paper delivered before the Ottawa meeting of the Canadian Mining Institute, and then the muck, which is 18 ft. thick on Dominion Creek, is sluiced through a channel about four feet wide at water level. The water is first conducted through flume hose to the edge of the creek bank where it trickles down and erodes vertical channels in the face. Men are employed to pass up and down the stream, clearing any obstructions which would check the current, and the course of the channel is so directed as continually to undercut the bank. When the undercut and the vertical channels are about three feet deep, the sections are blasted into the stream, and exposure to sun, wind and current rapidly disintegrates them. Automatic splash dams are in operation higher up on the creeks so as to provide sufficient water for flushing out every few hours any obstructions in the channel.

It was estimated that in this operation the bank receded from four to seven inches per day. The ditch last year was 10 ft. deep, leaving seven or eight feet more to be eroded before reaching the gravel. The estimated cost of this work was given as 10c. per cu.yd. of muck removed, but if an increased water supply is provided, this can be materially reduced.

Assuming the ultimate success of this method, its most striking inefficiency is the long, narrow, shallow and irregular area which is stripped, incapable of immediate working by dredging. And since the preceding winter's frost would not permit beginning dredging operations before some time in July of each season, although the dredge recovery per operating hour would be greater than from dredges handling the overburden as at present, the recovery per dredge season would, in Mr. Payne's opinion, probably show no material gain.

The water seems to be carrying its full duty in this operation, as an examination of samples taken indicates an average specific gravity of 2.55 for the solids carried, and an amount carried in suspension equal to 2.41% by volume, or 6.2% by weight. The fall of the channel is from 17 to 25 ft. per mile.

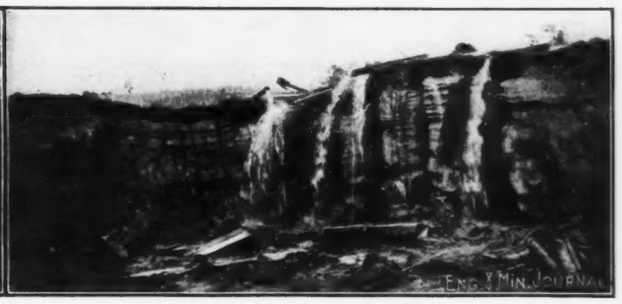
Mount Marcy, an Adirondack peak which rises 5344 ft. above sea level, is the highest point in New York, according to the U. S. Geological Survey. The average or mean elevation of the State is estimated at 900 feet.

PHOTOGRAPHS FROM THE FIELD

TUNDRA BROKEN BY PLOWING

BURNING TUNDRA MUCK AND STUMPS

FIRST SLUICING OPERATION



TRICKLING WATER ERODING VERTICAL BANK

BREAKING PIECES OF BLASTED BANK TO FACILITATE THAWING

ROUGH EARTH DAM HOLDING STREAM AGAINST BANK FOR UNDERCUTTING

LARGEST CLEARED AREA WITH RECEDING BANK OF OVERBURDEN

KEEPING DITCH CLEAR AT LOWER END TO INSURE STEADY FLOW

GROUND SLUICING FROZEN OVERBURDEN ON THE GRANVILLE MINING CO.'S PROPERTY IN THE KLONDIKE

South African Electric Hoisting Systems

Both the Ward-Leonard and the alternating-current systems of electric hoisting are in use on the Rand and neither has as yet been definitely adopted as unqualifiedly superior to the other. The Ward-Leonard system involves the use of a motor-generator set to rectify the alternating-current and the use of a direct-current hoisting motor, while the alternating-current system applies the alternating current direct to hoisting. If current consumption alone were the criterion, says A. W. Brown (*Trans.* North of England Inst. of Min. and Mech. Eng., November, 1912), a choice could readily be made by comparison of power consumption. If the ratio of energy consumption during full-speed hoisting to energy consumption during acceleration is 1.4:1, the systems are on a par; if the ratio is greater, the Ward-Leonard is more economical and *vice versa*. As a matter of fact, other considerations have determined the choice by engineers. The Ward-Leonard is higher in first cost, but gives an easier and more simple control, while the alternating-current system is cheaper, simpler in general and more reliable.

Two Different Equipments at the Brakpan

At the Brakpan No. 2 shaft, there are two equipments side by side doing the same work. The alternating-current hoist is used only for hoisting ore, as it has but one economical speed; the Ward-Leonard is used also for ore and for all shifting, handling materials and inspection work. The conditions during ore hoisting are the same for each. The distance hoisted through is 3800 ft.; the weight of ore is five tons; of the skip, three tons; of the hoisting rope, seven tons; of the tail rope, seven tons. There are on each shaft two 7x11-ft. drums, which make 96 r.p.m. when giving the normal rope speed of 3500 ft. per min. A single trip takes 80 sec., with 20 sec. additional for dumping. The alternating-current equipment comprises a 1500-hp. motor direct-connected to the drum shaft, a liquid controller, multitooth clutches, and brakes applied by weights and released by compressed air. The Ward-Leonard installation comprises a 1500-hp. induction motor, a 1200-kw. direct-current generator, a 1450-hp. motor coupled direct to the drum shaft, an exciter and a drum equipment similar to the other. It has power losses totaling about 260 electric horsepower and a consumption of six electric horsepower in the air compressor. The alternating-current hoist has losses of 100 electric horsepower and a consumption of 11 electric horsepower in its air compressor and controller pump.

Figures of actual performance are lacking, but it is calculated that the Ward-Leonard consumes 103,490 electric horsepower-seconds per trip, plus 114 electric horsepower-seconds for each second of standing time over the 20 seconds allowed for dumping. The corresponding figures for the other are 114,720 per trip and 11 for the idle time. Assuming both hoists in operation 16 hours per day and 300 days per year, hoisting rock 60% of the time in service and standing idle ready to run for 40%; then the Ward-Leonard consumes 204 units per day less than the other. Power being about 1.2c. per unit, this amounts to $765 per year. The cost of the Ward-Leonard hoist complete, delivered was $42,555, of the other, $34,055; a difference of $8500 in favor of the alternating-current hoist. At 11% for interest and depreciation, the Ward-Leonard would cost $935 more per year in fixed charges, which is not made up by the saving on power.

It is to be noted in contradistinction to common practice in this country that tail ropes are used on all four skips. Neither of the systems described employs a flywheel accumulator as in the Ilgner system.

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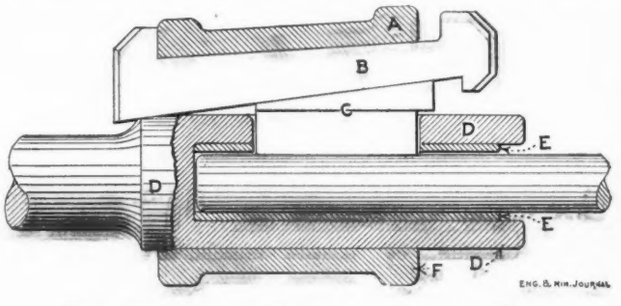
The Schorlemmer Drill Chuck

A new chuck for piston drills, operating on the familiar wedge-key principle, but embodying some new features, is illustrated in the accompanying drawing, which is partly a section and partly a side elevation. For application to any piston drill, the end of the piston rod *D* is first turned to a diameter of 2¼ to 2⅞ in., according to the size of the machine and the drill steel. It is also slotted longitudinally as is the bushing *E*. In this slot the block *C* works, the pressure of which on the shank of the steel, holds it securely. The whole is surrounded by the collar *A-F*, which at *A* has an extension, slotted on its inner surface in an inclined manner to admit *B*, the wedge key.

In operation, the chuck is self-tightening; when the steel is inserted and the first blow of the piston is struck, the collar and key are thrown forward and the



Self-tightening Chuck for Piston Drill

key, by its wedging action against the collar, forces the block *C* against the shank. This pressure is only increased by subsequent blows of the machine. To release the chuck, the forward end of the key *B* is struck with a hammer, loosening it and the block *C*.

The dimensions of the various parts are so proportioned that they can hardly fall off from the piston accidentally, but can be detached by proper manipulation. Thus *C* has a projecting upper portion which prevents its falling through the slot in the piston rod and bushing. The lower projection on the front of *B* catches on *C* and prevents *B* from slipping backward. The upper projections on front and back also keep *A* from slipping. If it is necessary to take the pieces off, *C* is allowed to fall as far inward as possible, *B* is held up against the collar *A* and the lower front projection on *B* will then clear *C* and both *A* and *B* can be drawn back and off *C*, thus releasing the entire device.

The chuck, which is the invention of H. W. Schorlemmer, of Rossland, B. C., has been used in various British Columbia mines for some time. It is handled by Donaldson & Farnham, 308 Concord Building, Portland, Oregon.

Graphics Applied to Fault Problems

By E. R. Rice*

SYNOPSIS—Movement may take place in any direction along the fault plane. Given sufficient data, the degree and direction of this movement may be ascertained by the methods of descriptive geometry. Cases of rotary motion may be similarly treated. In the case of combined rotation and translation the resultant of both movements may be ascertained.

Faults may briefly be classified as normal or tension faults, and reversed or thrust faults; the former being the more abundant. The average mining engineer is prone to think of a fault as a simple movement along the fault plane parallel to its dip, or in other words he conceives of the hanging wall moving up or down with respect to the foot wall, but he does not conceive of any lateral displacement. This conception is erroneous, for movement may take place in any direction along the fault plane. If the path described by a point in the faulted body is a straight line, the movement is that of pure translation, but if the path described by the point is curved, then the movement is that of rotation. The movement may also be that of combined translation and rotation.

If faulting consisted of a simple movement along the fault plane parallel to its dip, we could solve the amount of the total displacement if we knew the strike and dip of the fault plane and the strike, dip and total heave of the faulted and unfaulted portions of a vein or stratum. For the sake of convenience, throughout this article, I conceive of the foot wall of the fault as having remained stationary, and the hanging wall as having moved.

As movement may take place in any direction along the fault plane, to make a correct solution it is necessary to know the strike and dip of the fault, and the strike, dip and total heave of the faulted and unfaulted portions of two veins or strata. Or it is necessary to know the strike and dip of the fault; the strike, dip and total heave of the faulted and unfaulted portions of a vein or stratum, and the direction of the fault movement. The latter can sometimes be told by the striæ or slickensides on the fault plane. In saying that it is necessary to know the total heave, I mean that it is necessary to know certain components of the fault movement from which the total heave may be computed, for it is very seldom that the total heave can be measured directly.

As above stated it is necessary to know the strike and dip of the fault and the strike, dip and total heave of the faulted and unfaulted portions of two veins or strata. Sometimes the strike and dip can be measured directly, but in case they cannot, it is necessary to determine the position of three points in the vein, whose strike and dip is to be found, and from these, compute the strike and dip.[1] If either the strike or dip is known, it is then necessary to determine the position of only two points. If the total heave cannot be measured directly, it is then necessary to measure the horizontal and vertical distances between two points in the faulted and unfaulted portions of the two veins or strata. These points are best taken at the intersections of the faulted and unfaulted portions of the veins or strata with the fault plane, though it is not absolutely necessary. When they are not so taken, it is also necessary to take the bearing of the line joining the two points.

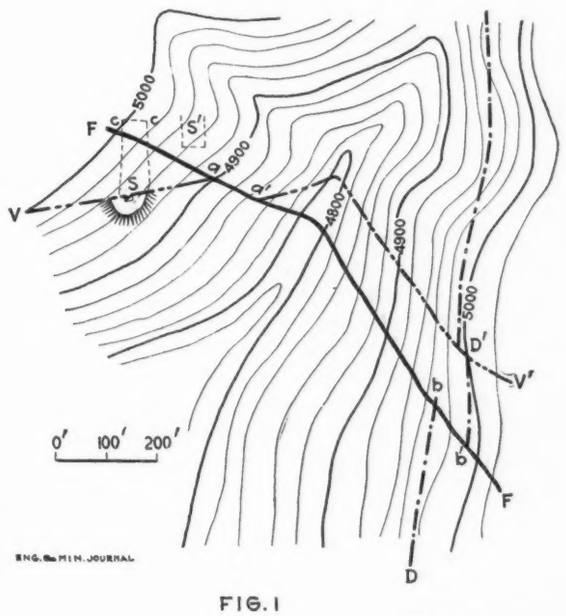


FIG. 1

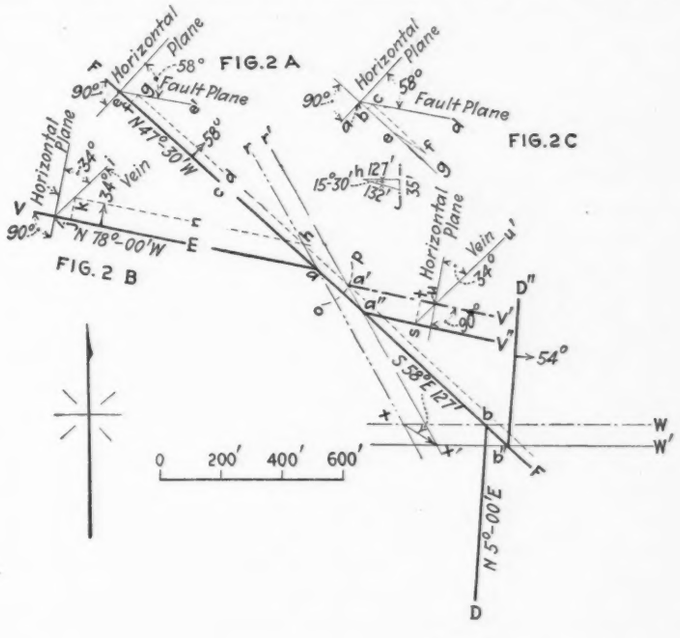


FIG. 2

FAULT MOVEMENT OF PURE TRANSLATION

*Mining engineer, care of Southwestern Miami Development Co., Miami, Ariz.

[1]Eng. and Min. Journ., p. 685, Oct. 12, 1912. "Determination of the Strike and Dip of Strata," by E. R. Rice.

Movement of Pure Translation

Suppose we have a case as shown in Fig. 1, where we have an oreshoot "*S*" in the vein *VV'*, displaced by the fault *FF*. The problem is to find the continuation of the oreshoot on the other side of the fault.

The vein *VV'* and the dike *DD'* are also faulted by *FF*. From our field work we have determined that the strike of the fault is N47° 30'W and its dip is 58° to the northeast. The strike of the vein *VV'* is N78°W and its dip is 34° to the north and the horizontal and vertical distances between *a* and *a'* are 110 ft. and 52 ft. respectively. The strike of the dike *DD'* is N5°E and it dips to the east at 54°, and the horizontal and vertical distances between *b* and *b'* are 87 ft. and 22 ft. respectively.

The fault *FF* is plotted as shown in Fig. 2, with a strike of N47° 30'W, and the unfaulted portions of the vein *VV'* and the dike *DD'* are plotted as shown at *Vma* and *Db*, with strikes of N78°W and N5°E respectively. The next step is to find the positions of the faulted portions of the vein and dike with respect to the unfaulted portions. The solution involving the vein only will be given as that concerning the dike is performed in the same way.

With *a* as a center, describe the arc *oa'p* with a radius equal to 110 ft., which is the horizontal distance between *a* and *a'*. (See Fig. 1). This arc will be the locus of all points that are 110 ft. distant horizontally from *a*, and therefore *a'* will lie somewhere in this arc. Draw a vertical cross-section through the fault as shown in Fig. 2A. The line *ege'* will be the fault plane shown in vertical cross-section, the angle of dip of the fault being 58°. Make *ef* equal to 52 ft., which is the distance that *a'* is below *a*. Draw *fg* parallel to the horizontal plane or perpendicular to *ef;* intersecting the fault plane *ege'* at *g*. Draw *gdha'* parallel to *FcaF*. The line *gdha'* will be the locus of all points in the fault plane that are 52 ft. below *a*. The line *gdha'* will intersect the arc *oa'p* in the point *a'* and *a'V'* drawn through *a'* parallel to *Va* (the strike of the faulted and unfaulted portions of the vein *VV'* are the same) will be the intersection of the faulted portion of the vein *VV'* with a horizontal plane 52 ft. below *a*.

The next step is to find the intersections of the faulted and unfaulted portions of the vein with the fault plane *FF*. Draw the cross-section of the vein as shown in Fig. 2B. Make *ij* equal to *ef* and draw *jk* perpendicular to *ij*, intersecting *iki* at *k*. Draw *knh* parallel to *Vma*, intersecting *gdha'* at *h*. Draw *rha* through *a* and *h*, and *rha* will be the intersection of the unfaulted portion of the vein *VV'* with the fault plane *FF*. If there has been no rotation during faulting as in this case, the dip and strike of the faulted and unfaulted portions of the vein will be the same, and the intersections of both portions of the vein with the fault plane will be parallel and a line *a" a' r'* drawn through *a'* parallel to *rha* will be the intersection of the faulted portion of the vein with the fault plane.

In case the strike and dip of the faulted portion of the vein should not be the same as that of the unfaulted portion, the intersections *rha* and *a"a'r'* will not be parallel. In such a case, draw *a'tuV'* through *a'* with a strike equal to that of the faulted portion of the vein as actually observed. Draw the cross-section as shown, making the dip (here shown as 34°) equal to that as actually determined in the field. Make *ut* equal to *ef* and draw *st* perpendicular to *a'tuV'*, intersecting *suu'* at *s*. Draw *a"sV"* through *s* parallel to *a'tuV'*, intersecting *FF* at *a"*. Draw the line *a"a'r'* through *a'* and *a"* and this line will be the intersection of the faulted portion of the vein with the fault plane. *FF*, *Va*, and *V"a"* will all lie in the same plane and *aa"* will be the total heave of the faulted portion of the vein *VV'*. If the intersections *rha* and *r'a'a"* are not parallel, a rotary movement has taken place and the problem must be solved as given later for rotary faults.

After finding the intersections of the faulted and unfaulted portions of the vein with the fault plane, the intersections of the faulted and unfaulted portions of the dike with the fault plane are found in a like manner, the intersections being shown at *bW* and *b"W'*. All four intersections are extended until they intersect as shown; the unfaulted intersections or traces intersecting at *x* and the faulted at *x'*. *xx'* will be the horizontal component of the fault movement, the direction being from *x* to *x'*, or from the unfaulted toward the faulted intersections. The direction of the movement is measured with a protractor and is shown in its true relation at *xx'*. In the example here given the horizontal component of the fault movement is 127 ft., and the direction of the movement is *S*58°*E*.

Method of Finding Total Displacement

To find the amount of the total displacement, the vertical component of the fault movement and the angle of dip along the fault plane from the unfaulted portion of the oreshoot *S*, to the faulted portion *S'*, proceed as follows: Construct the cross-section of the fault as shown in Fig. 2*C*. Draw *abeg* parallel to *FF* and take *e* at any point in the line *abeg*. Draw *ef* parallel and equal to *xx'*. Through *f*, draw *fc* parallel to *abeg*, intersecting *acd* at *c*. The line *fc* will be the locus of all points in the fault plane that have the same elevation as *f; f* being equivalent to the point *x'*, in Fig. 2. Draw *cb* perpendicular to *abeg*, intersecting *abeg* at *b*. The line *ab* will be the vertical component of the fault movement. Draw *hi* horizontal and equal to *xx'* and draw *ij* perpendicular to *hi* and equal to *ab*. The distance *hj* will be the amount of the total displacement and the angle *ihj* will be the angle of dip of the fault movement. Therefore in this case, to find the lost portion of the oreshoot *S*, it will be necessary to sink a winze from where the oreshoot was lost; the bearing of the winze being *S*58°*E*, its dip 15° 30', and its depth 132 feet.

It is to be noted that in finding the intersections of the vein with the fault plane that the distance *ef*, *ij* or *ut* can be made any amount desired, the greater the better.

In this case it was taken as 52 ft., on account of using the same lines for finding the intersections of the vein with the fault plane and also finding the faulted portion of the vein *VV'*, thereby doing away with the confusion that arises from the use of too many construction lines.

In the example given above, the fault plane is inclined. In case the fault plane is vertical, the traces or intersections *rha*, *r'a'a"*, *bW* and *b"W'* have to be revolved into the horizontal plane, as explained later, before the total displacement *xx'* can be obtained.

Movement That of Rotation, or Combined Rotation and Translation

In Figs. 3 and 4 are shown two possible cases of how a rotary fault movement may be produced. Fig. 3 is an isometric representation of how a fault may pass into a monoclinal fold, and a rotary fault movement be developed thereby. In the figure, from A to P, the stress that has caused the faulting has been satisfied by flexure and rock flowage; while from P to N the stress has been too great to be satisfied by flexure and rock flowage alone and faulting has resulted. In the area roughly limited by Pbb', it is evident that the stress has been satisfied by faulting as well as flexure and rock flowage, while at cc', it has been satisfied entirely by faulting. It is evident that if the body b is faulted to b', it will describe some kind of a curve and the resulting movement will be the same as if it revolved in the fault plane, through an angle ρ about the same point or pole P.

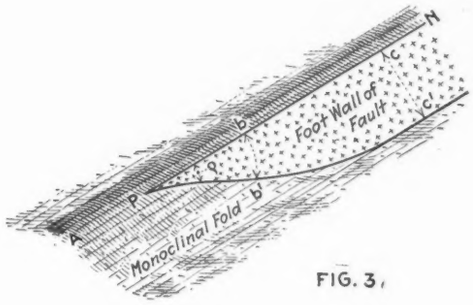


FIG. 3.

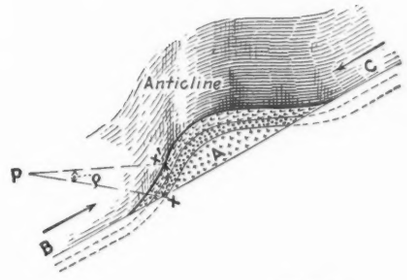


FIG. 4

In Fig. 4 is shown a case in which compression has taken place in the direction indicated by the arrows; forming the anticline A and the fault BxC along the line of maximum weakness BC. It is evident that if the body x is faulted to x', the resulting movement is the same as if x had been revolved in the fault plane through an angle ρ about some pole P. It is also conceivable that A could be a dome formed by a laccolith beneath and the strata faulted thereby, developing faults with a rotary movement.

It is evident that rotation will take place about an axis approximately perpendicular to the fault plane, and I consider the pole P used in the following solution as the point in which this axis of rotation intersects the fault plane. Tolman, in his "Graphical Solution of Fault Problems," states: "It is to be noted that the pole is not a point, as is sometimes the case in mathematical discussions, but is a line passing through the rotated portion of the block, extending to, and perpendicular to the fault plane." I prefer to call this line the "axis of rotation," and to define the "pole" as the point in which the axis of rotation intersects the fault plane.

It is evident that if rotary movement has taken place along a vertical fault plane, the dip of the faulted and unfaulted portions of a faulted vein will not be the same and the intersections of the faulted and unfaulted portions of the vein with the fault plane will not be parallel. The strike of the two portions of the faulted vein will not be the same unless the strike of the vein is at right angles to the strike of the fault plane. If the fault plane is inclined, the faulted portion of the vein will suffer change in both strike and dip.

As faulting may consist of combined rotation and translation, it is impossible to determine the amount and direction of both movements from a series of strata that have undergone combined translation and rotation. An "equivalent pole" may be located though, around which the known rotation will produce the displacements observed.

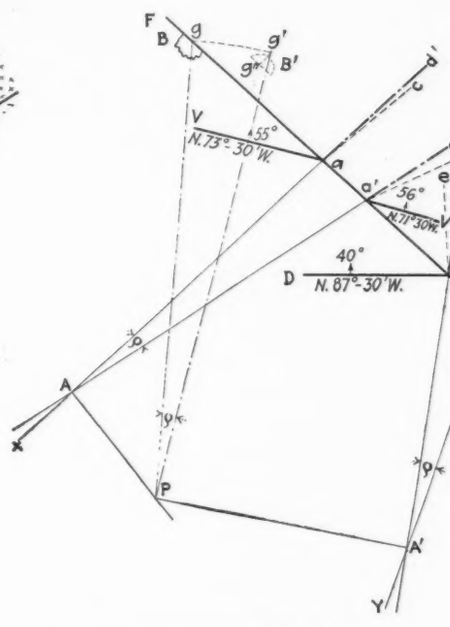


FIG. 5

FIG. 6

FIG. 5 A

Examples of Rotary Fault Movement

To Find the Equivalent Pole of Rotation

Suppose we have a case as shown in Fig. 5, in which an orebody B is displaced by the fault FF. The vein VV' and the dike DD' are also faulted by FF. The problem is to find the lost portion of the orebody B. From our field work, we have determined that the fault strikes N 45° W and dips to the northeast at 50°; the portion Va of the vein VV' strikes N 73° 30′ W and dips to the north at 55°, and the strike of the portion $a'V'$ is N 71° 30′ W, while its dip is 56° to the north. The strike of the portion Db of the dike DD' is N 87° 30′ W, and its dip is 40° to the north, while the strike of the portion $b'D'$ is N 85° W, and its dip is 43° 30′ to the north. This variation between the strike and dip of the faulted and unfaulted portions of the vein and dike indicate that a rotary movement has taken place.

The first step is to find the intersections of the faulted and unfaulted portions of the vein and dike with the

fault plane, as explained in the preceding part of this article. These intersections or traces are shown in plan at *ac, a'c', be* and *b'e'*. Then revolve these traces about *FF*, the strike line of the fault, into the horizontal plane, when they will assume the positions *ad, a'd', bf* and *b'f'*. To revolve these traces, proceed as follows: Draw the cross-section as shown at Fig. 5*A*. The line *oe"* will be the fault plane shown in cross-section, and the angle *f"oe"* will be the angle of dip of the fault. Take any point *e'* in the trace *b'e'* and draw *e'e"* parallel to *FF*, intersecting *oe"* at *e"*. With *o* as a center and a radius equal to *oe"*, describe the arc *e"f"*. Draw *f"f'* parallel to *FF*. Draw *e'f'* perpendicular to *FF*, intersecting *f"f'* at *f'*. Draw *b'f'*, which will be the trace *b'e'*. revolved into the horizontal plane. After the traces are revolved into the horizontal plane, extend them until they intersect in the points *A* and *A'*. If the vein *VV'* and the dike *DD'* have been subjected to the same movements, the angle *dAd'* will be equal to the angle *fA'f'*. This angle, which is designated by the Greek letter ρ, is the amount the dislocated strata have been rotated about some pole.

Bisect the angle *a'Ax* by the line *AP* and *AP* will be the locus of all points around which *Ad* can be rotated through the angle ρ into the position *Ad'*. In fact *Ad* can be rotated through an angle ρ, about any point in the line *AP* and take the position *Ad'*. Likewise, *PA'* bisecting the angle *bA'y*, will be the locus of all points around which *A'f* can be rotated through an angle ρ into the position *A'f'*. Extend *AP* and *A'P* until they intersect in the point *P*, which will be the point about which a rotation through an angle ρ will produce the displacements observed. This point *P* is called the "equivalent pole."

Draw the line *Pg* and also *Pg'* equal to *Pg*, but making an angle ρ with it; *g'* will be the rotated position of *g*, shown in the horizontal plane. Revolve *g'* back into the fault plane to *g"* and *g"* will be the location of the point *g*, after being displaced by the rotary fault movement here shown, and *B'* will be the position of the faulted orebody, shown in plan.

To Revolve a Trace Into the Horizontal Plane When the Fault Plane is Vertical

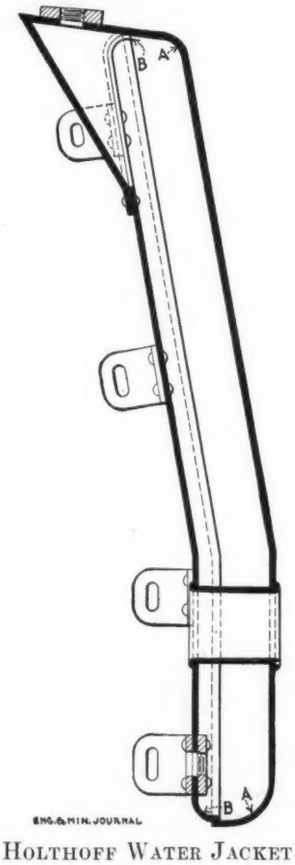
In Fig. 6, *a'V* is one portion of the vein and its trace with the vertical fault plane *FF* (here shown in plan) will lie in the line *FF*. Draw the vertical cross-section of the fault and vein as shown. Take any point *a* in the fault plane, and make *cd* equal to *oa*, and draw *de* through *d* perpendicular to *a'cd*, intersecting *ce* at *e*. Draw *ef* parallel to *a'cd*, intersecting *FF* at *f*, and *ef* will be the locus of all points in the vein that are a perpendicular distance *cd* or *oa* below *a'cd*. Draw *fg* perpendicular to *FF*. Then with *o* as a center and a radius equal to *oa*, describe the arc *ab*. Through *b*, draw the line *bg* parallel to *FF*, intersecting *fg* at *g*. Draw the line *a'g*, which will be the trace of the vein on the fault plane, after being revolved into the horizontal plane.

Mexican Magnesite Deposits

The British consul at La Paz, Mexico, states that deposits of high-grade magnesite, containing 92% of magnesium carbonate, have been found in the neighborhood of Magdalena (*Board of Trade Journ.*, Jan. 9, 1913). The largest bed has an area of about 30 acres, and is situated on Margarita Island; deposits have also been found on Cedros Island. A company has been formed to develop these deposits. One calcining plant will be installed on the Cedros Island and another on Margarita Island.

The Holthoff Water Jacket

A method for taking up expansion in a blast-furnace water jacket is provided for in U. S. pat. 1,047,055 issued to Henry C. Holthoff, of Milwaukee, Wis., and assigned to the Allis-Chalmers Co. This result is obtained by forming curves of large radius of curvature at the corners *AA*, shown in the accompanying illustration of a cross-section of a water jacket. The curves *BB* of the outer shell of the jacket are also given a comparatively large radius of curvature. The shallower flange of the outer sheet will not permit the use of as large a radius as is used in the fire sheet but at any rate the radius of curvature of the flange of the sheet should be substantially equal to the depth of pan formed.



Holthoff Water Jacket

With the large radii of curvature it will be noted that as the fire-sheet becomes heated and expands, the outer-sheet meanwhile remaining at approximately constant temperature, such expansion will be taken up in the curves at the corners of the two sheets. In cases of the ordinary construction, where the fire sheet only is flanged and the outer sheet is a flat plate, the expansion of the fire sheet must be taken up in the curve at the corners of the inner sheet entirely. It has been found in practice that such expansion of the fire sheet causes a rupture of the joint between these two sheets.

DETAILS OF PRACTICAL MINING

Safety Catch and Bucket Release

A bucket crosshead which combines the features of a safety catch in case of a rope break, with a device to release the bucket from the crosshead at any single desired point, has been devised by Henry A. Owens and Edward Benson, of Miami, Ariz. (U. S. pat. No. 1,052,948.) As will be seen by reference to the drawing, the crosshead consists of the usual shoes connected by three crosspieces made of channels. The channels contain holes through the centers of the webs to permit the passage of the cable under certain conditions and prevent it under others.

The block *A* is free to slide, by means of lugs, on the rods *B*. It extends upward as a cylinder *C*, the motion of which is guided by another cylinder *D*, fastened to

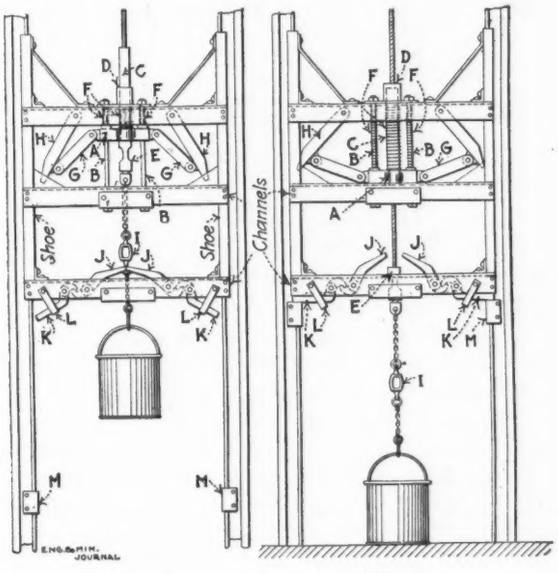


FIG. 1

FIG. 2

SAFETY DEVICE FOR BUCKET CROSSHEAD

the upper channel. The block *A* thus has a travel limited by the two upper channels. The coupling device *E*, is of such a size as not to pass through the opening in *A* and *C*. So, in hoisting or lowering the bucket and crosshead together, *A* is forced against the channel by *E*, as shown in Fig. 1, compressing the three springs *F*. The block *A* is connected by the links *G* to the dogs *H*, by pivoting as shown. If the rope breaks or tension is otherwise released, *A* is forced down by the springs *F* and the dogs are forced out so as to grip the guides, as in Fig. 2, and hold the crosshead and bucket stationary.

The link *I* and the apparatus on the lower channel are employed to hold the bucket to the crosshead except when it is desired to release it. The opening in the middle channel will always permit the passage of the coupling device *E*, and that in the lower channel will permit the passage of both *E* and *I*, but this is usually prevented by the jaws *J*, as shown in Fig. 1, which, are pivoted inside the flanges, of the channel, working through the hole cut in the channel web and being forked at their ends so as to grip the chain when closed and arrest the large link *I*. They are hooked at their lower ends and the latches *K* work in these hooked ends, as shown. At the point where it is desired to release the bucket, the usual stops *M* are attached to the guides. The latches striking these stops have their hooked ends forced down, thus raising the inside ends of the jaws and opening them until the link *I* can pass and the bucket is permitted to descend. Yokes *L* are provided to prevent the latches dropping to a vertical position and so missing the stops on the guides. Strength and reliability are claimed for the apparatus.

Energy of Various Explosives

It is well known that there is a great variety in the results produced by different classes of explosives, and it is the constant aim of the mine operator to use that class of explosive which will most economically and satisfactorily break the rock with which he has to deal. Two explosives of exactly equal energy content may differ materially in the work for which they are best adapted, says Dr. Walter O. Snelling (*Proc.* Engr. Soc. Western Penn., Vol. 28, No. 8), and in selecting explosives we have, therefore, to consider other factors in relation to the total energy available. An explosive which evolves its gases rapidly, such as blasting gelatin, has a shattering effect and is called "brisant." While an explosive, such as black blasting powder, which is relatively slow in its action, and has a heaving effect, is called "slow burning." The first exerts its energy largely as percussion and is adapted to breaking tough rocks; the latter has a propellent action and is particularly available for soft formations.

To select from two explosives the one best suited for the work in hand requires knowledge of the total energy contained, the ratio between that available as percussive force and that which is propellent, and the toughness or brittleness of the material to be blasted. The most satisfactory method of measuring the total energy content is to fire the explosive in a metal container in water, and by noting the temperature rise of the known body of water, measure the heat units liberated. This method, of the explosive calorimeter, is simple and accurate. The result can also be obtained by calculation, if the quantitative chemical composition of the explosive and the resultant products is known. But this involves the expenditure of more time and energy than the explosive calorimeter method.

Another method often used is that known as the Trauzl lead block, in which a charge of explosive is placed in a bore hole in a block of lead and fired. The resulting enlargement of the bore hole measures the force of the explosion, but the method emphasizes the percussive effect and is, therefore, misleading. Black powder, for instance,

gives no result at all in the lead block. The ballistic pendulum is defective in the opposite way, in that it emphasizes the propellent force at the expense of the percussive. It consists of firing a charge of the explosive in a suspended cannon or in a stationary cannon with a suspended weight in front of it. The amount of the resulting swing of the cannon or the weight, is supposed to be a measure of the energy expended. An extremely brisant explosive, such as fulminate of mercury, would disrupt the cannon without swinging it.

A combination of the two methods just mentioned was proposed by Spencer P. Howell, of the Bureau of Mines, and should prove a practical and valuable test. It consists of using the Trauzl block as a pendulum, so that the percussive force can be measured by the amount of enlargement in the cavity and the propellent force by the amount of the swing of the block. Such a device is inexpensive and could be improvised by any mining company. Table I shows results of tests on various explosives.

TABLE I. TOTAL ENERGY OF EXPLOSIVES

Explosive	Energy in foot tons from 1 pound	Energy in calories from 1 kg.
Blasting gelatin[1]	1148.9	1,640,000
Blasting gelatin[4] (7%) nitrocellulose)	1075.3	1,535,000
Blasting gelatin[5] (7.29% nitrocellulose)	1085.6	1,551,000
Blasting gelatin[3]	996.3	1,422,000
Nitroglycerin[1]	1107.0	1,580,000
Nitroglycerin[4]	1029.8	1,469,800
Nitroglycerin[6]	1157.3	1,652,000
Nitroglycerin[7]	1099.9	1,570,000
Dinitroglycerin[6]	859.9	942,000
Dynamite, 75%[1]	903.8	1,290,000
Dynamite, 75%[1]	819.7	1,170,000
Gelatin dynamite, 65%[3]	925.5	1,321,000
Gelatin dynamite, 65%[4]	879.6	1,267,000
Dynamite, 40% active dope[1]	903.8	1,290,000
Dynamite, 40% active dope[6]	864.6	1,221,400
Dynamite, 30% active dope[4]	721.6	1,030,000
Picric acid[1]	567.4	810,000
Picric acid[4]	611.7	873,200
Carbonite No. 1[3]	421.1	601,000
Donarite[3]	585.7	836,000
Aetna coal powder A[3]	517.2	738,300
Aetna coal powder B[3]	532.8	760,500
Carbonite No. 1[2]	539.5	770,100
Carbonite No. 2[2]	498.6	711,700
Carbonite No. 3[2]	494.4	705,700
Carbonite No. 1, L. F.[2]	481.1	686,700
Carbonite No. 2, L. F.[2]	465.7	688,200
Coal Special No. 1[2]	563.9	805,000
Coal special No. 2[2]	524.8	772,500
Coalite No. 1[2]	502.6	717,400
Coalite No. 2 D[2]	553.1	789,600
Collier powder No. 2[2]	388.2	696,900
Collier powder No. 4[2]	533.8	762,000
Collier powder No. 5[2]	603.5	861,400
Masurite M. L. F.[2]	695.5	992,800
Metor A X X O[2]	427.8	610,600
Monobel[2]	796.6	1,137,100
Black powder[1]	479.9	685,000
Black powder[3]	402.1	574,000
Black powder, F. F. F.[3]	553.0	789,400
Mercury fulminate[1]	287.2	410,000
Mercury fulminate[4]	288.1	411,200
Nitrocellulose (13.30% N_2)[6]	743.2	1,061,000
Nitrocellulose (13% N_2)[1]	770.6	1,100,000
Nitrocellulose (13.47% N_2)[4]	728.1	1,039,300
"Pyrocellulose" powder (12.75% N_2)	671.7	958,830
Nitrocellulose (12% N_2)[1]	511.4	730,000
Nitrocellulose (11.11% N_2)[4]	557.1	795,100
E. C. Powder[6]	560.4	800,000
S. S. Powder (English)[6]	559.7	799,000
Troisdorf (German)[6]	660.6	943,000
Rifleite (English)[6]	605.3	864,000
B. N. (French)[6]	583.5	833,000
Ballistite (German)[6]	904.5	1,291,000
Cordite (English)[6]	877.9	1,253,000
Balistite (Italian and Spanish)[6]	922.7	1,317,000

References:
[1] = Brunswig.
[2] = Bureau of Mines.
[3] = Bichel.
[4] = Heise.
[5] = Gody.
[6] = Juptner.

To determine percussive force alone, the "small lead-block test" is common and satisfactory. Cylindrical blocks of lead, usually 1½ in. in diameter and 2½ in. long, are used, and a charge of the explosive to be tested, usually about 50 or 100 grains, is made up in a cylinder of the same diameter. A disk of steel is placed between the charge and the block, and the charge is fired. The compression of the block is taken as a measure of the percussive force of the explosion. The usual "rate of detonation" tests are too elaborate and too subject to variable conditions, but a simple and inexpensive method developed by Doutriche for measuring the rate of detonation promises to be useful. The propellent factor is commonly measured by measuring the gas pressure, but this is inaccurate. The Howell pendulum, as described, offers a convenient method of determining both factors at one time.

In Table II, some of the more common mining explosives are arranged in order of their percussive force, commonly referred to as their "strength." Since the percussive force varies in inverse ratio to the propellent force, the same table holds for the propellent force in inverse order. This table is convenient for determining the necessary change where it is felt that the proper explosive is not being used. Thus, if it be found that 30% dynamite is not breaking the rock, is not sufficiently shattering, the explosive next above in the table can be tried and the process continued until satisfactory results are obtained. In a blasting operation, the rock must first be fissured and then moved out and shaken up. The percussive factor of the explosive performs the first operation; the propellent factor, the second.

TABLE II. COMMON EXPLOSIVES IN ORDER OF DECREASING PERCUSSIVE AND INCREASING PROPELLENT FORCE

High Percussive Force
Nitroglycerin
Blasting gelatin
65% gelatin dynamite
60% dynamite, active dope
50% dynamite, active dope
40% dynamite, active dope
30% dynamite, active dope
"40%" ammonia dynamite
"40%" gelatin dynamite
Granular nitroglycerin powder
Black powder (fine-grained)
Black powder (coarse-grained)
High Propellent Force

It is a common delusion that the force of an explosion is exerted downward. The falsity of this belief can be proved by using the "small lead-block test" with the charge below the block. No difference can be observed from the effects produced when the charge is above.

There is undoubtedly much loss of energy in the use of explosives through failure to select the type best adapted to the work in hand, and also through use of unsuitable detonators. Lack of accurate data is often the cause of both mistakes. Methods of measuring the effect of detonators have usually given only their strength, which may or may not correspond to their detonating effect. It has been found that if the detonator be placed in a steel vessel in sand graded between 20- and 40-mesh, the detonating effect is measured by the pulverization.

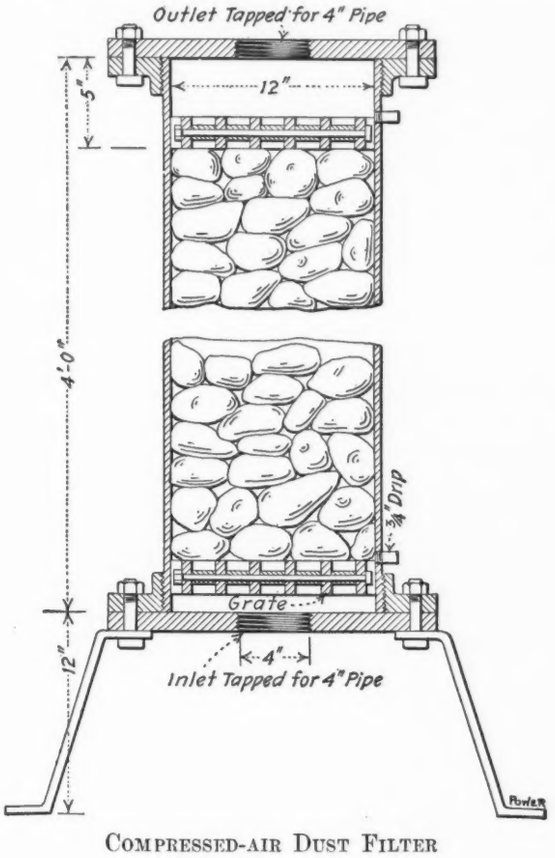
Steam Shovel Track Connection

In an article with this title by E. C. Hingston in the JOURNAL of Feb. 15, two mistakes were made for which Mr. Hingston is not responsible. The statement, "the vertical flanges fit under the head of the rail and prevent a sideways roll" is erroneous, inasmuch as this function is performed by the casting fitting over the base of the rail; and in the drawing sufficient clearance is not shown on the side of the base of the rail, this being necessary in order to swing the rail in making a curve. An advantage of the connection, not mentioned, lies in the fact that the ends of both rails are on one metal plate and thus the tops are always maintained at the same level, which is not always possible when using bridle-bars.

Filter for Compressed Air

Dust from an ore-reduction plant was drawn through an air compressor and caused trouble in the pneumatic tools. To obviate this the filter shown in the drawing was devised to set in the compressed-air line. It would seem as if a more logical remedy would have been to filter the air drawn into the compressor and thus save the wear on the valves and cylinder of the machine. It is to be noted also that any attachment of this nature is likely to increase the frictional resistance of the line.

The filter is described by W. G. Harris in *Power,* Mar. 11, 1913. A piece of 12-in. pipe, about 4 ft. long, was fitted with cast-iron screwed flanges on both ends. A cast-iron plate, tapped for a 4-in. pipe, was bolted to the lower end, also four wrought-iron supporting legs. A rough grate, made up of strips of ¼x2-in. flat iron with



COMPRESSED-AIR DUST FILTER

¾-in. pipe separators 1½ in. long, and held together with one ½-in. bolt 11¼ in. long, was placed on the bottom. The pipe was filled to within 5 in. of the top with stones about the size of a large orange. The stones were dipped in a thick, sticky refuse oil. As it was thought that in time the oil would work to the bottom, a second grate, similar to the other, was placed on top of the stones so the apparatus could be turned over and used in a reversed position. A flange and gasket similar to that on the bottom was placed on the upper end. Drip cocks were also placed near each end so that any accumulated water might be removed. The line from the compressor was then connected to the bottom flange, by nipples, ells and flanged unions; the same arrangement was used on the upper end to convey the filtered air to the machines. Since installing this device it has been cleaned twice in two years, and on each occasion it was found that a large amount of dirt, lint, etc., had been collected without any reduction in the efficiency of the oil.

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Copper Queen Mine Power Plant

Power for the Copper Queen mines, in Bisbee, Ariz., is generated by five 407-hp. water-tube boilers, equipped with superheaters and economizers, writes Charles Legrand (I. M. M. *Bull.* No. 101). The steam pressure at boilers is 155 lb. per sq.in., and the temperature of the steam leaving the superheater, approximately 440° F. California crude oil containing 18,400 to 18,500 B.t.u. per lb. and weighing 8.05 lb. per gal. (231 cu.in.) at 60° F. is burned. In regular operation the heat content of the superheated steam, over that of the feed water to the economizers, is 82% of the total heat in the fuel. The boiler feed pumps are electrically driven and no feed-water heaters are used. The fuel-oil pumps and steam used in atomizing the fuel oil take approximately 4% of the total steam generated.

The boiler plant furnishes steam for the power plant and for two hoists. The power plant consists of three air compressors, two of which are two-stage, driven by compound engines, each delivering 3500 cu.ft. of free air per min. at a rated speed of 75 r.p.m.; the other is a two-stage compressor driven by a triple-expansion four-cylinder engine, delivering 7000 cu.ft. per min. at a rated speed of 72 r.p.m. The air pressure is 90 lb. gage per square inch.

Electrical power is generated by three 500-kw. vertical steam turbo-generators, delivering a three-phase, 2300-volt, 60-cycle current. A portion of the alternating current is transformed into a 260-volt direct current by means of two 200-kw. rotary converters.

The engines are all connected to individual ejector condensers, the injection water being cooled by an open-air cooling tower, three motor-driven rotary pumps, of 2500 gal. per min. each, being used to circulate the water. The power used by circulating pumps, boiler-feed pumps and lighting of plants takes about 8.5% of the total power generated.

The compressed air operates five first-motion hoists and two geared hoists, several hundred air drills and tools, a few air-jet blowers and some small air hoists in the mine. The air for the surface hoist is reheated to about 275° F. The old boilers at the various hoists are used as air receivers. The average air consumption in 1911 was 6127 cu.ft. free air per minute. However, as the mines are worked only for 16 hr. per day, six days a week, the consumption during working hours is probably 9000 cu.ft. per minute. Two of the first-motion hoists take air for a few seconds at a rate of over 5000 cu.ft. per min. when starting. These require from 1400 to 1600 ft. per shaft horsepower-hour. To compress this quantity of air takes from 50 lb. to 55 lb. of steam, approximately 50% of the amount required, using steam direct.

The electrical power is used by several motor-driven hoists, by oil pumps, by 11 electric locomotives underground, varying in weight from three to seven tons, for lighting and for motor-driven sawmills and shops. Most of the ore is hoisted at one central shaft in skips and delivered to the railroad cars by conveyor belts.

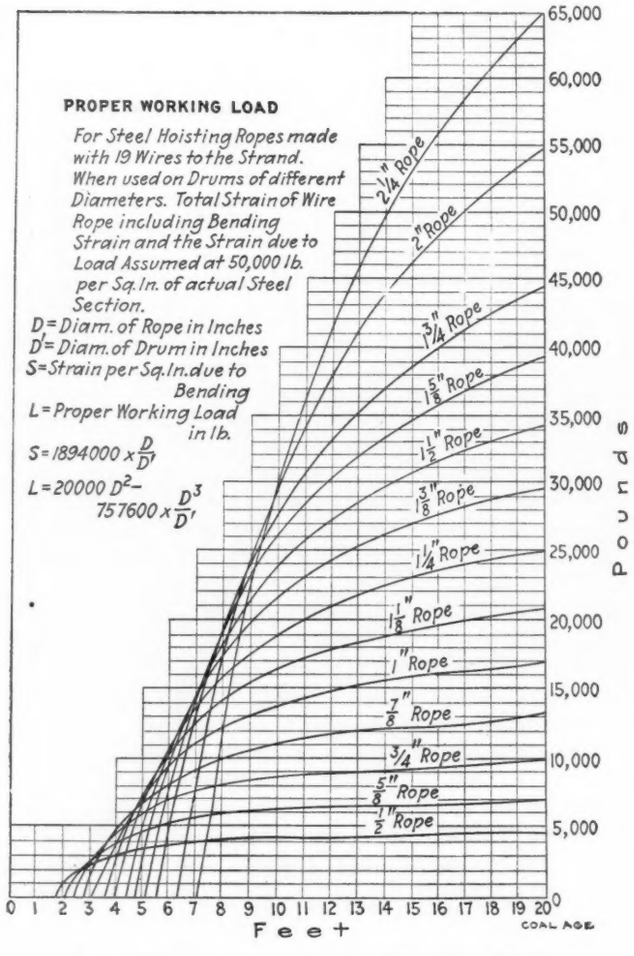
The steam hoist at this shaft is a twin, tandem-compound, condensing engine, hoisting from six different

levels. Under everyday operating conditions the steam consumption, including power used in circulating water for condenser, is 32 lb. per shaft horsepower-hour.

This power plant replaced five smaller plants situated at the various shafts, and has been in operation since 1908. At the same time as the new plant was started, the new central hoisting shaft was put in operation, electric traction introduced in the mines, and the number of air drills in use increased considerably. Pumping is less than it was. The fuel-oil consumption in 1907, the last year under the old conditions, was 115,023 bbl., and the ore extracted, 469,822 tons. The fuel-oil consumption in 1911 was 56,590 bbl., and the ore extracted was 601,424 tons.

Chart for Calculating Hoisting Ropes

The accompanying chart, from which either the safe loads for ropes of various sizes, working on various size pulleys, or else a suitable combination of cable and pulley



SAFE WORKING LOADS FOR HOISTING ROPES

diameter to carry a given load, can be ascertained, is one constructed by George L. Phillips and published in *Coal Age*, Mar. 1, 1913. The chart is extremely conservative, as the figures are based on rope made of medium steel, with an ultimate strength of 60,000 to 70,000 lb., having six strands of 19 wires each. A safety factor of five is employed. As regards the ultimate strength, a figure of 100,000 lb. per sq.in. is frequently given for cast-steel rope and in some current English discussion[1], 100 tons is taken as a standard. The figures given for working load, cover the weight of the rope and the weight on the end. The bending stresses are allowed for in the table. Thus the safety factor of five is not far different from that of six, which is frequently used for a load in which bending stresses are treated as unknown. The question of safety factors for hoisting ropes is one much mooted at present. It is established by law on the Rand at six, when men are hoisted or lowered, and this is ultimate, that is, the rope must never fall below a strength six times as great as the stresses, even when it is old. However, the figure is based on the hoisted load and weight of rope alone. Bending stresses are considered unknown. It is urged that the factor is unnecessarily high for the deep shafts and works on them an unnecessary hardship; inasmuch as it is designed to cover the great and unknown stress caused by jerking, such as starting with slack rope; and in deep shafts the long stretch of rope acts as a spring so that these stresses are almost eliminated. Therefore it has been proposed by Dr. W. Glucksman that the safety factor be reduced, somewhat in proportion to the hoisting depth, until for 5000 ft. it is only 2.28. There has also been suggested the use of a fixed addendum to the working load instead of a multiplier, thus removing some of the penalty on hoisting heavy loads, but this would seem to be rather illogical.

The question of sheave and drum size is one that must be considered for each individual hoisting installation. Unquestionably large sheaves and drums decrease bending stresses, permit the use of lighter rope and prolong the rope's life. These are economies which must be ballanced against the increased first cost of the larger drums and sheaves. For sheaves, the increase is not much, but for drums it becomes an important consideration.

In the chart presented, the abscissas are sheave or drum diameters and the ordinates are safe-working loads. The curves are for various rope diameters as shown. To use the table, suppose it is desired to find the safe-working load for a 2-in. rope on a 12-ft. drum. By tracing up the 12-ft. line until it intersects the 2-in. curve a corresponding ordinate of 38,000 lb. is found for the load in question. Where the 2-in. line crosses the 2¼-in. line, will be the minimum size of sheave for a 2-in. rope. The chart will give results far lower than do the manufacturers' tables, which are usually considered extremely safe.

The chart also labors under the disadvantage that no account is taken of the depth of shaft. This introduces a variable in the shape of the weight of the rope itself; since the total weight will vary with the size of the rope and the size of the rope in turn will vary with the total load. Hence the table must be entered several times and a result obtained by approximations.

For Sinking Circular Colliery Shafts in England, the Wilker sinking frame is sometimes used. It consists, says "Science and Art of Mining," Feb. 1, 1913, of a central cylinder resting in the shaft bottom, which serves as a reservoir both for air for actuating the drills and water under pressure for cleaning the holes. Attached to the cylinder are eight radial arms on which the drills are mounted. These are tightened against the side of the shaft. When a round is completed the arms are turned up into a vertical position, the drills placed in the center, and the whole hoisted to any point desired.

[1] "Electrically Driven Winding Engines in South Africa," Appendix V, by A. W. Brown ("Trans.," North of England Institute of Mining and Mechanical Engineers, Vol. LXIII, Part 1).

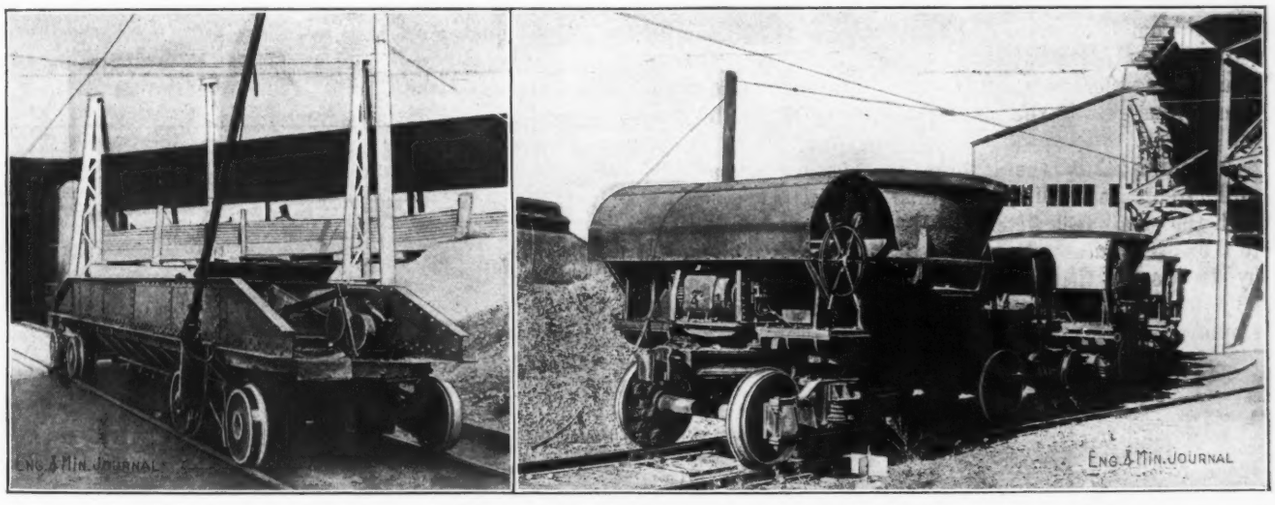
DETAILS OF METALLURGICAL PRACTICE

Motor Operated Charging and Slag Cars

Where larries or charging cars are to be used singly or in trains of not more than two or three, greater flexibility is obtained by having them self-propelled by electric motors. Operations can also be carried on more rapidly because delays occasioned by waiting for the locomotive are obviated.

In the illustration at the left is shown a motor-driven charging car installed in the lead department of the International Smelting & Refining Co., at Tooele, Utah. This car is equipped with two Westinghouse No. 64 motors, one on each truck, with the controller mounted in a horizontal position at the end of the car. The motors and controller are of the street-railway type somewhat modified for the special service required. The brush holders, commutators and bearings are designed for long service. The lubrication is simple and adequate for long periods of operation. The important characteristics claimed for these cars are ability to develop great power in small space, reliability and ease of inspection.

Motor-tilted slag cars are now used at many smelting plants. The illustration at the right shows a slag car of the International Smelting & Refining Co., having a Westinghouse No. 6, type K, direct-current motor mounted on the end of the car and protected by a canopy. It is series wound, entirely inclosed, and is dust and weatherproof. It is geared to the tilting mechanism and is designed especially to take care of heavy service of this character and withstand the high temperature to which it may be subjected.



MOTOR-OPERATED CHARGE AND SLAG CARS AT INTERNATIONAL LEAD SMELTERY, TOOELE, UTAH

On the Witwatersrand, 227 Air Compressors with a total of 103,791 indicated horsepower are in use, according to "South African Engineering," Jan., 1913, and in all South African mines, there are 296 compressors of 118,244 indicated horsepower. Of dynamos, both direct and alternating current, there are on the Rand, 232 with a total of 72,016 kw. and in all South African Mines, 656 of 113,767 kilowatts.

Crushing and Classification at Homestake

In discussing the paper of A. J. Clark and W. J. Sharwood on "The Metallurgy of the Homestake Ore," W. A. Caldecott takes up (*Bull.* 101, I. M. M.) certain considerations affecting the Homestake crushing and classification practice, as compared with the methods followed on the Rand, and which present a certain analogy as involving the treatment of large tonnages of low-grade ore in which a high percentage of the gold content is readily recoverable by amalgamation, followed by cyanide treatment; concentration and roasting being unnecessary in either case. The main characteristic of the Homestake equipment appears to be the large number of small units involved in handling a large daily tonnage. The thousand 900-lb. stamps, and the large number of cone classifiers employed, are striking illustrations of this tendency, which is counter to the policy in vogue elsewhere of utilizing as large units as possible for operations on a large scale.

The Homestake ore appears soft, which renders comparisons of crushing capactiy with hard pyritic banket ore difficult, and the grading analyses given are based on screens with apertures different from those in common use on the Rand. The cost of stamp milling and regrinding 2795 tons daily at Lead may be calculated from data in the paper to be 1s. 6.04d. per ton, and the pulp leaving the crushing plant to contain 19.3% + 100 mesh (0.0057 in.), and 80.7% — 100 mesh. The cost of crushing 2542 tons per 24 working hours at the Simmer & Jack Proprietary Mines, Ltd., during October, 1912, using a combination of steam-driven gravity stamps and of tube mills with more costly electric drive, was 1s. 4.453d. per ton, apart from water (0.500d.) and pulp elevation (0.819d.) costs, and the pulp leaving the crushing plant contained 28.8% + 90 mesh (0.006 in.) and 71.2% — 90 mesh.

The ratio of water to ore in the Homestake battery pulp is stated as 11:1, as compared with 4.5:1 in the pulp leaving the crushing plant at Simmer & Jack. The high discharge (10 in.) of the Homestake batteries necessitates the use of large volumes of water to wash out the crushed ore, but, even with cheap water and lime, the doubled volume of pulp produced entails a corresponding increase of amalgamated plate area and of classifiers for dealing with the pulp later, and may thus partly account for the 101 cones employed at the No. 1 plant, as against the fraction of this number which would be needed for larger units with a more concentrated pulp.

The stamp duty of 4.2 tons, based on the authors' data, is, of course, due to the use of light stamps and fine battery screen with high discharge. Although tube mills have been employed on a limited scale at the Homestake, the fact that crushing banket ore by their means costs 20% less than by stamps would appear to justify the consideration, even apart from the installation of heavier stamps, of shutting down at least half the thousand stamps, and replacing them by a dozen 5 ft. 6 in. by 22-ft. tube mills, while a sufficiently coarse battery screen, with low discharge, might be used to double the duty of the remaining 500 stamps. High amalgamation recoveries up to 74%, as at the Princess, are obtained with coarse stamp-milling pyritic banket ore, followed by efficient classification and tube milling, and, under similar conditions, it is probable that the amalgamation recovery from Homestake ore would rise, owing to the fine reduction of pyritic particles before overflowing the hydraulic classifiers of the tube-mill circuit, and the retention of amalgam in the most efficient trap which the tube-mill circuit constitutes.

As indicated by the authors, the absence of the tube-mill circuit has militated against satisfactory work, but with the small feed given—70 tons of sand per 24 hours to a 5x14-ft. tube mill—better results should be obtained by dewatering the pulp fed into the tube mill down to 28% moisture, in place of the 41.2% of moisture actually employed.

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Gas Engine Lubrication

A suitable oil for gas engine lubrication, says A. L. Brennan, Jr., in *Power*, Jan. 28, 1913, should have a flash point of at least 390° F. or better 450°; it should range in specific gravity between 26° and 30° Bé. and should show a viscosity of 180 to 220 at 80° F. No oil is suitable unless a byproduct of petroleum or a mineral oil. Oils which conform to these specifications and possess a thin body are undoubtedly the best. It is an erroneous idea that an oil to prove an efficient lubricant must have considerable body, as the thinnest oil that will remain in a bearing will invariably give the best results. Although, in the case of a warm bearing or for heavy pressures oil possessing considerable body will be useful.

Cylinder oils adaptable to one motor are not necessarily suitable for another. A high-speed machine lubricated by a splash system, that is, by the cranks dipping into oil contained in the base, requires a light or medium oil, while in heavy-duty, slow-speed engines dependent upon oil supplied from an oiler of the force-feed type, an oil of more body will give better results.

An excessive amount of oil either of a high or a low flash point will bring about detrimental effects. The first indications in the case of using a poor oil are manifest in decreased power, due primarily to the friction offered the surfaces of the piston and cylinder, secondarily to faulty compression from the piston rings becoming inoperative and thirdly to carbon deposits, which materially reduce the efficiency of the valves and impair the function of the spark plug, subsequently inducing pronounced carbon deposits that become incandescent and cause preignition. Good oil will lead to the same results if too much is used. A motor that requires, say eight drops of oil per minute per cylinder at 500 r.p.m. will require more oil when the speed is increased, as the piston's travel will cover a greater area. This condition is taken care of on motors using the splash feed system or mechanically-driven lubricators, for the supply of oil allowed decreases and increases with the speed; but unless the first adjustment is correct the increased amounts, when the motor is speeded up, will be proportionately at fault.

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Skimming Tailing Dumps

After sand or slime tailing has been discharged from cyanide treatment, whatever quantity of gold or silver it may contain is usually considered economically irrecoverable. It is interesting to note then, that some of these valuable metals are now being reclaimed.

The principle of this recovery is the concentration of previously dissolved gold and silver by evaporation from the surface of the dumps. The remaining salt may be

Skimming Slime Dump at Oatman, Ariz.

noted as a white crust, so thin that it is usually recovered by lightly sweeping the dump surface. A product having a value of more than $100 per ton has been recovered in this way from both gold and silver tailing. The process may be repeated indefinitely by sprinkling the dump with water or running on additional tailing and waiting for the moisture to evaporate.

In cases where the recovered material is not to be shipped but retreated in neighboring mills, it is not necessary to take off such a thin skim of material. The accompanying illustration shows the system in use at the Tom Reed mines, at Oatman, Ariz. The white, unskimmed portion is seen at the left of the photograph. Here the recovery of about half an inch of surface material is quickly and cheaply made by shoveling. It is put back through the mill treatment. The system is said to have been first used in the Oatman and Gold Road district of Arizona.

THE COST OF DOING THINGS

Cost of Development Plant

The accompanying table shows the items entering into the plant which was used for driving the Rawley adit, including both the first installation and expenses incurred during operations. The table was included in the paper presented by Messrs. Simonds and Burns before the February meeting of the American Institute of Mining Engineers. The conditions governing the operations have been previously described in the JOURNAL of Feb. 1, by Will C. Russell. In addition to the equipment given, there was used an 80-hp. return-tubular boiler, burning wood fuel, a 40-hp. boiler for reserve, and a Rand-Imperial, type 10 compressor, which were all on hand from previous operations. At the completion of the undertaking, certain of the items were considered as having some value and were credited to operations at $6925, 50% of their cost. F

EQUIPMENT FOR DEVELOPMENT PLANT

All labor	$4,300.06
Drills and fixtures	647.01
Drill-sharpener and fixtures	1,031.17
Engine and blower	800.46
Air-pipe, 12-in. and 13-in., for blower, and fixtures	3,254.04
Compressor air-pipe, 3-in. to 6-in.	1,543.91
Drill-steel	916.48
Buildings and building supplies	933.45
Steel rails, 16-lb., bolts and spikes	1,849.78
Tram-cars	2,576.69
Mules and Harness	756.24
Steel plate for muck	84.44
Telephone line	77.93
Freight, express, etc	392.24
Compressor and boilers	335.77
Water-pipe	391.52
Miscellaneous	305.01
Total	$20,196.20

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Unit Costs of Covering Pipe

BY RUPERT K. STOCKWELL*

The accompanying table of unit labor costs was figured from daily records made while covering a high-pressure steam-heating line 2400 ft. long, running from the power house to the concentrator, and the steam and feed-water lines around two 450-boiler hp. reverberatory-furnace waste-heat boilers, at McGill, Nev., in October, 1909. The men who did the work were pipe fitters, rated at 50c. per hr., and helpers rated at 37½c. per hr. Each fitter had two helpers working with him.

The covering was standard magnesia pipe-covering, purchased from the H. W. Johns-Manville Co., and put on in strict accordance with their specifications, the high-pressure covering being 1½ in. thick, held away from the pipe by bands of magnesia 1 in. thick, spaced 18 in. apart. The covering for 10-in. pipe and larger came in keystone-shaped strips; this was placed on the magnesia bands, bound together with wire netting, all cracks plastered with magnesia mud and cement, and the whole covered with canvas; brass bands were then clamped over the canvas at intervals of 30 in., and then the whole was painted with a mixture of tar and gasoline. The high-pressure covering for pipe smaller than 10 in. came in half-cylinders, instead of keystone-shaped strips.

The low-pressure covering, which in this case was all for pipe less than 8 in. in diameter, came in half-cylinders, 1 in. thick and was placed directly on the pipe, without space rings. The finish was the same as for the high-pressure covering.

The magnesia covering for fittings, valves, expansion joints, and pipe bends, did not come shaped to fit, but had to be sawed and fitted to the work by hand, from magnesia strips and slabs. This was slow and expensive work. It is to be understood, that in the table, where a fitting covering is listed, the flanges are not included, all flanges are figured separately as part of flange unions.

LABOR COSTS OF APPLYING MAGNESIA COVERING TO PIPES AND FITTINGS

High-Pressure Covering

	Cost per Lin.ft.		Cost Each
4-in. pipe	$0.17	1¼-in. flange unions	$1.03
8-in. pipe	0.38	4-in. flange unions	1.25
10-in. pipe	0.79	8-in. flange unions	3.19
12-in. pipe	1.25	10-in. flange unions	3.40
8-in. pipe bends	1.03	12-in. flange unions	5.49
	Cost Each		
1¼-in. elbows	$1.30	1¼-in. valve bodies	1.60
8-in. elbows	3.30	8-in. valve bodies	3.28
8-in. elbows	3.58	10-in. valve bodies	3.60
12-in. elbows	4.90	12-in. valve bodies	4.90
4-in. expansion joints	2.60	8-in. valve bonnets	3.25
10-in. expansion joints	5.63	10-in. valve bonnets	3.60
12-in. expansion joints	6.15	12-in. valve bonnets	3.70

Low-Pressure Covering

	Cost per Lin.ft.		Cost Each
2½-in. pipe	$0.10	2½-in. flange unions	$1.15
4-in. pipe	0.12	2½-in. tees	1.30
		4-in. tees	1.75
		2½-in. elbows	1.30
		2½-in. valve bonnets	1.98

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Costs at Yuanmi Mill, West Australia

The costs at the new mill of the Yuanmi Gold Mines, West Australia, are reported in the *Monthly Journal* of the Chamber of Mines of Western Australia, November, 1912, as follows: Rock breaking, 5.30d.; ore transport, 2.45d.; milling, 2s. 3.19d.; vacuum filtration, 2s. 3.26d.; fine grinding, 4.34d.; precipitation and smelting, 4.45d.; disposal of residues, 2.23d.; total, 6s. 1.22d. per ton of ore treated. These figures are based on the milling of 5050 tons per month. The monthly tonnage has since been increased to 5500 tons. The average extraction of gold amounts to 90%. Owing to the presence of insoluble oxidized antimonial compounds, and of a little stibnite in the ore from the oxidized zone, it is impossible to obtain an extremely low tailing.

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The Calumet & Arizona Mining Co. for the year 1912 smelted about 177,000 tons of 4.606% copper ore including the fluxing ore, and of the returns from this operation about 41% was profit over operating expense. The Superior & Pittsburgh Copper Co., in the same camp, under the same management, smelted about 288,000 tons of 6.361% ore at the same plant, which showed a profit equal to about 55% of the value of the contents. The richer ore and higher tonnage would be expected to show a greater difference in the percentage of profit than is represented by 41% and 55%. The discrepancy is probably to be explained by the difference in mine-operating conditions. Tonnage, grade, situation and management are not the only factors determining costs and no intelligent comparison of results is possible without knowing the details of operating conditions.

*Chief engineer, Braden Copper Co., Rancagua, Chile.

Disseminated Replacement Copper Deposits

By C. W. Botsford*

SYNOPSIS—For the formation of a replacement, disseminated copper deposit, certain conditions must be fulfilled. A large, homogeneous acid intrusion is necessary, subject to slow cooling to the proper temperature and widespread fracturing. Primary mineralization by cupriferous solutions replacing the rock minerals must be followed by an uplift and exposure to leaching with consequent secondary enrichment. Arid or semi-arid conditions and a mature topography are most favorable. Leached, carbonate and chalcocite zones, found in typical deposits.

The disseminated copper deposits may be divided into two types, namely: (1) The Miami type, in which the primary mineralization is effected mainly by replacement; as at Ray, Miami, Santa Rita, Ely and Bingham; (2) The Nacozari type, in which the primary mineralization is effected mainly by the impregnation and filling of minute fissures and in which the process of replacement is of only minor importance, as at Nacozari and Braden. This article deals only with the geology of the first, or replacement type, and from observable facts attempts to deduce the various conditions necessary to their existence as well as the limitations of these criteria.

Briefly, what is now understood as a disseminated copper deposit, is a large body of low-grade ore formed by a general impregnation and replacement of large volumes of rock with cupriferous pyrite, enriched by secondary concentration. Many of the general geological principles involved in the formation of these deposits apply equally well to copper deposits of other kinds, especially to veins in wall rocks of granitic composition and to a less extent to contact metamorphic deposits. The principles of secondary concentration are well known and the results are in a general way the same in any deposit affected by this process.

In discussing the subject, the following sequence will be followed: (1) The intrusion; (2) cooling and fracturing; (3) primary mineralization; (4) exposure to atmospheric influences; (5) secondary concentration; (6) climatic and topographic conditions.

Intrusion Is Granitic to Monzonitic

In all cases the disseminated copper deposits have an intimate connection and close genetic relationship with intrusions varying from granites to monzonites in composition. All these intrusions, so far as known, belong to the volcanic period following the Cretaceous and are presumably related to the various uplifts and disturbances which occurred at that time. In the Southwest the intrusives of this period are predominantly monzonitic, but only a small percentage have resulted in commercial copper deposits. Many conditions outlined later are fully as important as an intrusion of the proper character.

A large percentage of silica and iron in the rock is necessary for the formation of an ore deposit, as will be discussed later. The composition of any of these intrusions may vary locally, due to magmatic differentiations from dioritic to alaskitic types, but neither extreme is likely to be much mineralized.

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The composition and physical characteristics of the rock should be regular, as variations in character will cause variations in the amount of primary mineralization and, consequently variations in the results of secondary enrichment. This is liable to make a bunchy, irregular orebody which will be more difficult and expensive to mine. The conditions of homogeneity are best realized in a large intrusion which cools uniformly, probably at a considerable depth. A large intrusion is also necessary because the related ore deposits, being very low grade, must be themselves large to be profitable.

The intruded rocks and their characteristics are of great importance. At Miami and Ray the intrusion came into Pinal schists of the proper silica and iron contents. These were later fractured and mineralized along with parts of the intrusion. These intrusions were large enough and at sufficient depth to heat large adjacent areas to at least the minimum temperature of pyritization, probably about 400° Centigrade.

At Bisbee, where the intrusion came into limestones, the porphyry carries only very low-grade ores, although it is of the proper character for mineralization. This is due partly to the fact that secondary concentration has not acted to great depths, but probably mainly to a preference of the primary mineral-bearing solutions for the limestone. The disseminated deposits are more likely to be found in the neighborhood of the contacts of the intrusion and these should in all cases be carefully studied.

The first necessary condition for the existence of ore deposits of this class is a large intrusion of a monzonitic character, containing a considerable amount of iron minerals.

Slow Cooling and Fracturing Essential

Slow cooling is preferable, as it maintains more uniform conditions throughout the mass, which are conducive to more uniform fracturing and consequently to a more uniform later mineralization. Fracturing must take place after the intrusion has cooled sufficiently below the point of solidification to break and not to flow and still at high enough temperatures to permit the pyritization. The temperature limits are probably between about 800° C. and 400° C. Fracturing below this limit would not be extensively mineralized.

At least some of the fracturing is formed at the higher point as shown by the contained minerals, epidote, tourmaline, pyroxene, molybdenite, etc., which form at higher temperatures than the pyrite. The molybdenite overlaps the formation of the pyrite and is found in most, if not all, of the deposits of this class. In all probability the fracturing was a long-drawn-out process, covering a considerable interval of time and was probably caused directly or indirectly by strain due to the cooling and weight of the intrusion.

Acid Rocks Give More Thorough Fracturing

The nature of the fracturing is most important. It must be a general and thorough shattering of immense volumes of the rock mass. This depends on the strength, homogeneity and brittleness of the rock itself and the

nature of the strains to which it is subjected. Rocks of a granitic to monzonitic composition seem to have the proper amount of brittleness for thorough fracturing, while a diorite is probably too flexible. Instead of shattering, the basic rocks are liable to bend and at their breaking point to develop main fissures which would result in vein deposits with a localization instead of a dissemination of the metals. The factor of brittleness probably bears a direct relation to the percentage of silica in the rock and an inverse relation to the percentage of iron minerals.

Strains Causing Fracture Should Be Widespread

This general condition of fracturing is caused by intense strains over a large area, which, however, usually result in no great displacement at any one point. Strains which cause much movement are apt to result in a fault-vein system with a lack of the general fracturing necessary for the formation of a true disseminated deposit. A combination of governing fissures and related disseminated ores occurs at Clifton-Morenci and in the Burro Mountain districts. At Miami and Ray the fracturing has affected the Pinal schists in the same manner as the intrusive and both have been subsequently mineralized.

In all cases it is important to determine the zones of greatest strains and resultant fracturing, as these factors have determined the channels of circulation both of the ascending and descending solutions and, therefore, govern the location of the ore deposits.

The second process in the formation of this type of deposit, is the general, thorough fracturing of a large mass of rock in or near the intrusion, while at a temperature probably above 400° Centigrade.

Primary Mineralization by Alteration and Replacement

In general, the primary mineralization is an alteration and partial replacement, with a minor filling of the small fissures of the rock, by mineral-bearing solutions. This results in a quartz-sericite rock impregnated with cupriferous pyrite. The metamorphism is largely by recrystallization, but partly by replacement with foreign material brought by the ascending magmatic solutions. With the gradual cooling of the intrusion the solutions change in composition with a corresponding change in the results of metamorphism.

The first effect of impregnating solutions is the alteration of the iron minerals; first the pyroxene, next the amphiboles, and lastly the biotite. These break up into chlorite, silica and iron oxides and the feldspars begin the alteration into sericite and quartz. The iron oxides unite with the sulphur of the solutions, forming pyrite. This stage of the process is propylitization with some pyritization, and the pyrite is not usually very cupriferous.

When this process is continued, a further breaking up of the chlorite and remaining feldspars into silica, sericite and iron oxides results, with a much more complete pyritization with cupriferous pyrite. This final stage of the process seems to be necessary for the formation of bodies of primary ore sufficiently rich in copper to result in commercial orebodies. The biotite seems especially refractory in this process and frequently remains when the rock is generally thoroughly altered. In general any large proportion of iron minerals remaining, means an imperfect mineralization and a probably erratic ore occurrence.

Change in Chemical Composition

The chemical result of the metamorphism is an increase in SiO_2, Al_2O_3, K_2O, Fe, S and Cu, and a decrease in Mg, Ca and Na, all in small percentages. The mineralization solutions may be assumed to have contained the former elements, which replaced the latter, resulting in a solution containing Mg, Ca, and Na. These are common constituents of mineral springs. The alumina is probably stronger in the first stages of the process and the iron and copper in the latter.

The primary ores when well pyritized will probably not average more than from 0.3% to 0.7% Cu. It is evident that large bodies of these are needed for the formation of a commercial ore deposit.

A necessary condition, therefore, is the formation of large bodies of a quartz-sericite rock, with few remaining iron minerals, abundantly impregnated with cupriferous pyrite.

Exposure to Atmospheric Influences Necessary

As the copper tenor of the primary ores is too low to make them of any value at the present time, secondary concentration must be called upon. For this to act, the primary pyrite must be exposed to atmospheric oxidizing influences and the circulation of surface waters. From the deep-seated nature of the primary ore-deposition, an uplift and great erosion are necessary. This makes it very probable that this class of deposits will only be found in mountainous country. It is probable that the uplift, fracturing and mineralization are all more or less contemporaneous.

Secondary Concentration Process

When the masses of primary ores are exposed to atmospheric influences, the first effect is the oxidation of the sulphides and the formation of iron and copper sulphates with free sulphuric acid. These solutions work to lower levels and in contact with an excess of pyrite, among other effects, replace the iron with copper, forming chalcocite. When these solutions meet an excess of calcareous material, copper carbonates are deposited. Chalcocite, when in turn oxidized, results in cuprite, and with an excess of free sulphuric acid, native copper may form. These minerals usually occur close to the chalcocite zone.

The resultant leached rock shows very little copper and is a mass of quartz, sericite and kaolin with other minerals, the whole much stained with iron oxides. The original presence of the primary pyrite is shown by the iron stains and the pitted appearance of the rock from cavities from which the pyrite has been leached, and which are usually empty and stained with iron oxides.

From the surface downwards, one of these deposits will show the following section with usually no definite line of demarcation between the various zones:

(1) The leached zone with only traces or small percentages of copper with usually a gradual increase in the copper content in depth until it equals that of the primary ores. The minerals are all thoroughly oxidized and copper, iron and sulphur have been removed from this zone.

(2) The carbonate zone, in which copper has not been removed, and has usually been deposited as carbonate or

silicate with some oxides and frequently native copper near the base. The copper contents of this zone may assay comparatively high, but are not usually commercial ore, except in cases of high-grade veins and stringers.

(3) The chalcocite zone contains the copper leached from the ground above. These ores can be concentrated and form the present commercial orebodies. Below this are the unaltered primary ores. All the zones are gradually working downward.

The sulphide concentration is frequently spoken of as occurring at the ground-water level. This is not strictly the case, as replacement will occur at whatever depths the waters bearing copper sulphate may penetrate; which is likely to be much below the water level, especially in veins or in irregularly fractured ground. Also recent changes in elevation may have caused the water-level to have changed since the deposition of the sulphides.

Great Volume of Primary Ore Essential

Assuming that the primary ores run 0.4% copper and the chalcocite zone, 2%, this means a concentration of five to one. Allowing for enrichment of the carbonate zone and losses of copper residual in the leached zone and carried away by surface waters, it probably requires at least 20 volumes of primary ore to produce one volume of commercial ore. It is evident that enormous quantities of mineralized ground are necessary for the derivation of one of this type of ore deposits.

It is shown by the foregoing that a large volume of leached ground, of the character described, where the products of leaching were able to produce a secondary concentration, must have existed.

Climatic and Topographic Conditions

The conditions essential for disseminated deposits are equally necessary for any copper-ore deposit which is dependent on secondary concentration for the enrichment of its ores to the point of economic value. With the necessary primary ores, proper conditions of climate and topography are indispensable. Many deposits exist in Arizona and Sonora which have every other condition necessary for a perfect ore occurrence except that the climatic and topographic conditions are, or have been, unfavorable.

To obtain a successful secondary concentration, it is necessary: (1) To oxidize the pyrite; (2) to get the copper in solution as sulphate; and (3) for the solutions to penetrate to depths where they will encounter unoxidized pyrite.

The pyrite is oxidized by exposure to atmospheric influences, and surface waters, originally rainfall, must form the solutions. This establishes a certain minimum amount of rainfall. As the solutions must penetrate to considerable depths underground, this indicates a country of considerable relief and a rate of erosion slower than the rate of oxidation. To maintain the latter conditions the rainfall must not be too great as this tends toward too rapid erosion, too youthful topography, and the probability that the copper oxidized has been lost, "down the creek," and is, therefore, not available for secondary enrichment.

The above conditions are best realized in an arid, or semi-arid country with considerable relief, usually about middle-aged topography or a country which weathers into rugged types in the higher altitudes with a fairly stable basic water level.

In this connection it is conceivable that changes may have occurred in very recent times and that an ore deposit may exist under present unfavorable climatic and topographic conditions which was formed under very different preëxisting favorable conditions. As secondary concentration is a long process, probable previous climates and topography must be studied to determine the possibilities of one of this class of deposits.

Summary of Governing Conditions

Summing up this article the necessary phenomena attendant on the formation of a disseminated copper-ore deposit of the replacement type are as follows:

(1) An intrusion of granitic to monzonitic rock of some size, carrying a considerable percentage of iron minerals.

(2) After solidification a general fracturing, while still at high temperatures. This may affect neighboring rocks which may subsequently be mineralized.

(3) The mineralization of large volumes of rock by cupriferous pyrite with the necessary accompanying metamorphism resulting in a quartz-sericite rock with few remains of the iron minerals.

(4) Uplift of mass and exposure to atmospheric conditions.

(5) Large areas showing residues from leaching.

(6) Arid to semi-arid conditions and a rather mature topography where the rate of erosion must be slower than the rate of oxidation.

With these conditions fulfilled, the existence of a disseminated orebody is probable. Its exact tonnage and value can, of course, only be determined by systematic drilling operations or by underground work. A careful geologic study will usually confine this work to the most promising zones and will always add greatly to a proper understanding of the nature and possibilities of the ore deposit.

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Daly-Judge Report

The report of the Daly-Judge Mining Co. for the year ended Dec. 31, 1912, shows that the mine at Park City, Utah, produced 62,606 tons of ore, the net value of which was $728,381. The surplus at the end of the year was $524,570 after the payment of $225,000 in dividends.

Total development work amounted to 9784 ft., of which 4002 ft. were driven during the last three months of the year. Since Sept. 1, 1912, systematic exploration has been done under the contract system; it is stated that approximately double the footage is driven in a given time with no greater cost per foot than previously.

The mill treated 58,951 tons of ore from which 13,419 tons of lead concentrates and 4300 tons of zinc middlings were made. The ratio of concentration was 4.4 tons of crude ore into one of lead concentrates, or with all products combined, 3.4 tons into one.

In 1912, one Wilfley table, one multi-deck Wilfley slimer, two Callow tanks, one Richards-Janney classifier and one new jig were added to the mill equipment, which resulted in a closer saving and a better separation of lead from zinc.

The average value of the various products per ton for the year is given as follows: 3655 tons of crude ore, sold

for $30.23 per ton, assaying 34.83 oz. silver; 0.045 oz. gold, 19.72% lead, 1.75% copper, 19.89% zinc, 11.28% iron; 13,419 tons of concentrates, sold at $35.09 per ton, the analysis being 32.27 oz. silver, 0.031 oz. gold, 29.71% lead, 1.60% copper, 15.30% zinc, 14.50% iron; 5425 tons of zinc middlings sold at $27.29 per ton, averaging 22.58 oz. silver, 0.019 oz. gold, 5.16% lead, 40.46% zinc and 8.17% iron per ton.

South America through Yanqui Eyes

By a Mine Foreman

I send you by mail a bulletin on the tin mines and industry in general in this country, which I hope will prove interesting. It was written by a member of the Peruvian Society of Mining Engineers, who was commissioned by his government to make a study of the formation, mode of occurrence of the veins or lodes, the economic geology generally of the *yacimientos de estaño,* to see if similar formations and conditions existed in the contiguous provinces of Peru. They have been unable to discover tin in commercial quantity in the neighboring republic; consequently his studies were not productive of results.

Tin, the Greatest Source of Revenue in Bolivia

Tin is the greatest source of revenue possessed by this country as the export tax is 3½ *bolivianos* per *quintal* (*Español*) of 46 kilos of *barrilla. Barrilla* is 65% tin or better. A less percentage than this is taxed in proportion. The standard of value is the *boliviano,* worth about 38½c., U. S. Cy., or 19d., English; 12½ Bs. = £1. This is the fixed rate of exchange by which the banks do business with foreign countries; also the government sees to it that this ratio is not trifled with or changed. At present writing the London quotation for tin is £232. From this you can appreciate what such a price means to mines that were working when the selling price was only £150 per ton. It is really equivalent to copper at 18c. per lb. to a mine that has a margin of profit when the red metal is only selling at 12c. The production of all the tin mines is being forced to the limit, wherever possible.

The production of this property this month will reach nearly 10,000 *quintales,* with a profit of about £4 per *quintal.* Rather handsome, as the capital is only £425,000 (shares £1, par value). When I came here, May 30, the production was less than 4000 *quintales,* with the *acciones* quoted in Santiago, Chili, at 35 *pesos Chilenos.* Now they are 105 *pesos.* In other words, they have trebled in value. This is not all due to my efforts, although I have helped some. (The *peso Chileno* varies in value according to the speculation and manipulation of the market. At present the exchange is about 24 *pesos* to the English pound; say 10d. for each *peso.* From Panama south all moneys are reckoned in English pounds Sterling.

It would take a long letter to describe the different currencies in circulation in the various countries; for the present I hope this will suffice to give you an idea, so that the values and terms mentioned may be intelligible to you. This is a *Compañia Chilena,* and all connected with it are of that country. I am the only Norte Americano (we are called *yanquis* all through these countries, never Americans) hereabouts; consequently feel rather lonesome as far as nationality is concerned.

I will not attempt to describe this property, as it would require a very elaborate description, on account of its size, area, number of veins and workings generally; but will try and give you a few facts, as they may prove of interest.

Our richest vein is on the contact between trachyte and slate. It has an average width of 90 cm.; *ley,* 20% tin. We have other veins, sometimes widely separated and distant from the slate, but the main characteristics are the same. The faulting and earth movements have been very extensive, and it is along these main faults that the greatest mineralization has taken place. On the upper levels the ore is all oxide, cassiterite, while on the lower, in the sulphide zones, it is stannite, sometimes carrying as much as 3% copper, with bismuth, antimony, a little silver and other associated minerals. The veins are all narrow, 25 to 30 cm. being a fair average. As the specific gravity is high, it does not take much ore to make a ton.

Difficulties of Local Conditions

The system of mining is very expensive and out of date. South Americans don't know how to mine nor do they seem capable of appreciating what economical mining means. I have been trying to introduce reforms, but have been unable to do as much as I would wish. These Bolivian workmen *"son muy atrasados en la escala de la civilizacion"* and one has a Herculean task who undertakes to change their customs or mend their ways. However, I have done a little in this direction; therefore feel amply rewarded for my pains.

At these extremely high altitudes, 14,000 ft., the labor efficiency is very low, taking the United States or Mexico even, as a standard. *Barreteros* earn from five to six and seven *bolivianos* per day. Peon labor will average about four *bolivianos.*

Supplies of all kinds are excessively dear. One box of dynamite, 55 *bolivianos;* fuse and caps in proportion; timber, of which none exists, 350 *bolivianos* per M. There is no fuel worthy the name; coal being imported for power purposes. Its cost is about 140 *bolivianos* per metric ton. Gas engines are generally employed for power purposes, as steam is really impossible on account of the altitude. There is no vegetation at these altitudes. A rabbit can be seen a mile away. For domestic purposes the natives use the dung of the llama called *taquia,* also a shrub called *yareta* that grows about two inches high. Fuel for heating purposes is not to be thought of.

Spanish is the official language of the country, it being the language of the educated as well. The principal language, and the one generally spoken, is *Quichua* or *Inca.* Many of the natives speak no other; therefore to conduct business one needs an interpreter, if he is not acquainted with the latter language. The natives are more docile than the Mexicans, are not given so much to quarreling and fighting with knives and guns.

The government is good for such a country, and from what I can see, well established in the affections of the people, with no fear of a revolution for many years to come, if ever. The franchise is free to every male 24 years of age and over; if he does not vote, he is liable

Note—Excerpts from a letter written by an American mine foreman in Bolivia to his former employer, the manager of an important group of properties in the United States; an account of personal impressions on the west coast of South America.

to a term in jail. I understand that foreigners are also entitled to the franchise after a continuous residence of four years, but of this I am not positive. There is considerable prejudice against Americans and things American, as for some unknown reason they consider us their enemies. The business of the country is almost entirely in the hands of foreigners, principally Austrians and Germans. These latter seeming to be crushing out all competition, particularly the English, who had almost a monopoly of the principal lines of trade in days gone by. Competition between the different nationalities is very keen, and it seems as if the Germans were on the winning side. All they think about is the commercial conquest of these South American countries.

Peruvian and Chilean Experiences

Since leaving Mexico I have traveled a great deal. I was in Peru before going to Chile. From the latter country I came here. While in Peru, I did some prospecting for a time and later did some contracting in one of the mines; could have remained there but did not like the place. Was there more to study the country, mine and methods, than for the money to be had. I must say that I was disappointed when I saw the way the property was being managed and worked. I don't think that I am exaggerating when I state that the mining costs could be lowered at least 25 or 30% by introducing the necessary reforms. Those contract men from "dear New York" imagine they are only on an excursion with nothing serious to trouble them until their time has expired, when they can return whence they came. To begin with they know nothing—lacking both knowledge and experience—so what can you expect? I sometimes feel sorry for the shareholders of such concerns, but sifted down, they deserve no better service, they receive just what they deserve.

I saw and visited several mines, principally copper, in northern Chile, had a few good offers, but did not like the country, so would not stay. Southern Chile is much different from the northern part; the latter, with few exceptions, being nothing but a dry, wind-swept pampa, offering nothing to either man nor beast. It is as unattractive as can be imagined.

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Newspapers and the Post Office

The *Wall Street Journal* says that relations between the post office and the newspapers in the matter of second-class mail have reached a crisis which will require all the energies of the new postmaster-general.

Newspapers published in New York and elsewhere enjoying any considerable out-of-town circulation are in despair. They cannot get papers delivered in anything like reasonable time. Boston newspapers reach this office sometimes two days or more after they are published, and Philadelphia deliveries are nearly as bad. Many newspapers have abandoned hope of delivery through usual channels, and have advised former subscribers to get copies through the news agents, who possess the sense and system the post office lacks. Every important newspaper in New York is losing subscribers daily by reason of a postal service which would hardly be tolerated in the most backward country in Europe.

And what is the reason for all this? It arises out of Mr. Hitchcock's fake surplus. That arrant humbug was arrived at by holding back at least $9,000,000 rightfully belonging to the railroads, cutting down the already overworked railway mail clerks in numbers by at least 30%, reducing the number of letter carriers in the constantly growing large cities, and especially New York, where the bulk of the revenue is earned, and by enforcing the eight-hours' work in 10 arrangement voted by Congress, which, with its usual fatuity, omitted to make any provision for extra hands to make up for the reduced hours of labor.

Everything has been sacrified to rural free delivery, instituted to catch the farmer's vote, and the new parcel post. Without additional help, the letter carriers are required to handle parcels, and also to give them right of way over newspapers. The consequence is a condition which denies the out-of-town reader what he has paid for and has every right to demand—the delivery of his newspaper while its contents are still fresh.

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The End of the Hawthorne Case

Julian Hawthorne, Dr. William J. Morton and Albert Freeman were found guilty, Mar. 14, in the United States District Court, of using the mails to defraud. Josiah Quincy, ex-Mayor of Boston, was acquitted. Judge Julius Mayer sentenced Albert Freeman to serve five years and three days in the Federal prison at Atlanta, Julian Hawthorne to serve one year and one day and Doctor Morton to serve one year and one day. The verdict was brought in at 5:45 p.m. by a jury which had been deliberating for 27¾ hours.

Judge Mayer, in pronouncing sentence, said:

This is an extremely painful duty, the most painful I have ever been called upon to perform. I would like to follow the dictates of my heart as a man, but I must not.

I shall take into account, however, the willingness of the defendants to continue the trial with a new judge in order, I am willing to believe, to save the Government extra expense. I shall give the defendants the benefit of this action; otherwise I should be more severe.

I shall also take into account the fact that the evidence shows the circulars were sent to intelligent people of small means—widows and teachers and army officers who had scant means of support.

I therefore sentence the defendant Freeman on the conspiracy count in the Elklake-Cobalt indictment to serve one year at Atlanta; on the substantive counts of the Temagami-Cobalt indictment to serve one year at Atlanta; on the conspiracy count of the Montreal-James indictment to serve a year at Atlanta, and on all the counts mentioned by the jury in the Hawthorne No. 2 indictment to serve two years at Atlanta. I suspend sentence on the Hawthorne No. 1 indictment and on all the other counts not mentioned.

This sentence will begin on January 1, 1913, in view of the presumptions of this trial.

In the case of the defendants Morton and Hawthorne I wish, on account of their age, that I could suspend all the indictments. I will, however, sentence them each to a year at Atlanta, the sentence to date from November 25, 1912 (on which day the trial began.)

After conferring with Mr. Proctor, Judge Mayer announced that he would change his sentences of a year wherever pronounced upon the defendant Freeman and as pronounced upon the defendants Morton and Hawthorne to a year and a day. This was to make the convicted men eligible for parole.

The affairs of this group of mine promoters were first subjected to Federal scrutiny in 1908, soon after the publication in the Engineering and Mining Journal and in the New York *Sun* of articles regarding their offerings to the public. Assistant United States Attorney Dorr, who has been chief

prosecutor in the trial just finished, and Assistant United States Attorney Thompson, together with Inspector Booth and other U. S. Post Office inspectors went to Canada and made a thorough investigation of the properties that were the subjects of Mr. Hawthorne's flamboyant literature. It was known from an early time that the notorious Albert Freeman was the king-pin of the business.

During the trial, it was admitted by the defendants that they obtained $600,000 from the public, of which $176,000 went into development work. The sum of $175,000 is unaccounted for and this the government says was divided among the defendants. According to the *Sun*, the trial has cost the government about $70,000 and the defendants about $50,000. It is the longest trial in the history of the Federal Building, with the exception of the Scheftel's case, in which George Graham Rice was a defendant and which lasted for 81 days. The government called 102 witnesses and the defense six. The testimony fills 8000 pages. One thousand one hundred and sixty-four exhibits were marked in evidence. Some of them included as many as 50 or more documents. The total number of documents in evidence was about 10,000. The papers in the case gathered by the defense and prosecution weighed close to a ton.

The trial began on Nov. 25, 1912, and its progress was marked by unusual bitterness and by a display of personal feeling on the part of the lawyers engaged in it. The Court was frequently called upon to ask counsel to moderate their remarks. Freeman was found guilty on 23 counts of the indictment and Hawthorne and Morton on 17. Quincy was acquitted on the one charge which stood against him, that of conspiring with the other defendants to defraud.

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President Thayer on Anaconda

B. B. Thayer, president of the Anaconda Copper Mining Co., recently returned to New York from a trip to Butte and the Anaconda mines. Mr. Thayer is quoted by Thompson, Towle & Co., in their *News Letter* of Mar. 12, 1913, as follows:

In Butte I found everyone cheerful. The camp is experiencing good times, and it looks much like the old days. The Anaconda properties are looking well, and the physical condition of the mines is as good as it has been for several years past. Development work carried on last year met with very good results.

The changes which we have been making for some time past in supplanting the steam hoist with compressed air is progressing well, and several of these plants are now in full operation. The other engines are being installed as fast as possible. While it is too soon to figure the actual saving effected by this method of hoisting over the old method by steam, results have proceeded sufficiently to convince us that it will prove a great saving to the company, and I might say that as a whole the work is giving entire satisfaction. In all departments we are continually striving toward greater efficiency and lower costs.

At the reduction works, the new system we are working out to effect greater saving in concentration is giving entire satisfaction. This method is merely one of more perfect classification. In the first section which has already been equipped with the new method, and operating for ninety days, results have been most satisfactory, and lead us to believe that a much greater extraction will be possible by this new system over our present method of concentration. To apply these changes to the concentrator, it will be necessary to shut down one unit of the plant at a time. This will necessarily result in a curtailment of output. Eventually, however, it will mean not only a greater production of copper, but the greater recovery indicated per ton will have a very material effect on reducing costs.

For several months the production of the company's mines has been considerably below normal. In January the company turned out roughly 21,000,000 lb. of copper. In February, though the production was somewhat higher, being approximately 21,250,000 lb., it was comparatively low owing to the 28-day month. For several months operations at the company's mines have been greatly handicapped owing to the severe winter weather which existed throughout the Northwest. In addition to the heavy snows which caused congestion in transportation, the extremely low temperature of often 10 deg. below zero made the handling of ore above ground extremely difficult.

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The Bureau of Mines Act

WASHINGTON CORRESPONDENCE

The revised draft of the bill to amend the Bureau of Mines Act, as passed by Congress and signed by the President, has just been made public. The essential features of the law as thus revised are as follows:

Sec. 2. That it shall be the province and duty of the Bureau of Mines, subject to the approval of the Secretary of the Interior, to conduct inquiries and scientific and technologic investigations concerning mining, and the preparation, treatment, and utilization of mineral substances with a view to improving health conditions, and increasing safety, efficiency, economic development, and conserving resources through the prevention of waste in the mining, quarrying, metallurgical, and other mineral industries; to inquire into the economic conditions affecting these industries; to investigate explosives and peat; and on behalf of the Government to investigate the mineral fuels and unfinished mineral products belonging to, or for the use of, the United States, with a view to their most efficient mining, preparation, treatment and use; and to disseminate information concerning these subjects in such manner as will best carry out the purposes of this Act.

Sec. 3. That the director of said bureau shall prepare and publish, subject to the direction of the Secretary of the Interior, under the appropriations made from time to time by Congress, reports of inquiries and investigations, with appropriate recommendations of the bureau, concerning the nature, causes, and prevention of accidents, and the improvement of conditions, methods, and equipment, with special reference to health, safety, and prevention of waste in the mining, quarrying, metallurgical and other mineral industries; the use of explosives and electricity, safety methods and appliances, and rescue and first-aid work in said industries; the causes and prevention of mine fires; and other subjects included under the provisions of this Act.

Sec. 4. In conducting inquiries and investigations authorized by this Act neither the director nor any member of the Bureau of Mines shall have any personal or private interest in any mine or the products of any mine under investigation, or shall accept employment from any private party for services in the examination of any mine or private mineral property, or issue any report as to the valuation or the management of any mine or other private mineral property: Provided, That nothing herein shall be construed as preventing the temporary employment by the Bureau of Mines, at a compensation not to exceed $10 per day, in a consulting capacity or in the investigation of special subjects, of any engineer or other expert whose principal professional practice is outside of such employment by said bureau.

Sec. 5. That for tests or investigations authorized by the Secretary of the Interior under the provisions of this Act, other than those performed for the Government of the United States or State governments within the United States, a reasonable fee covering the necessary expenses shall be charged, according to a schedule prepared by the Director of the Bureau of Mines and approved by the Secretary of the Interior, who shall prescribe rules and regulations under which such tests and investigations may be made. All moneys received from such sources shall be paid into the Treasury to the credit of miscellaneous receipts.

Sec. 6. That this Act shall take effect and be in force on and after its passage.

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Recovery of Coke from Ashes

According to *Power*, the recovery of the combustible remaining in coal ashes is receiving earnest attention in Germany, where it is said 150 million tons of coal are burned annually and about one-third of that amount is

burned in furnaces from which the ash and cinder would yield six to eight million tons of residual matter containing two to three million tons of combustible material. A mechanical process for separating the combustible matter from ordinary boiler and household ashes has been designed by Adolph F. Muller.

An experimental plant is said to recover 38 tons of coke ½ to 2 in. in size from 2000 tons of ordinary boiler ashes. Calorific tests have shown that this recovered material, when dry, contains about 84% combustible matter and has a thermal value of about 6500 B.t.u. per lb. The process consists in first crushing the ashes and then separating the ingredients, by placing them in liquids of different specific gravities. The slag left after the separating process is practically free from any combustible material and is found to be an excellent material for use in the manufacture of concrete blocks.

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An Attempt to Restrict Gold Dredging in California

By L. H. Eddy

The total amount of proved gold-bearing gravel lands available for dredging in California in the first half of 1913 will not exceed 11,000 acres; 70% of this land has no agricultural value. Of the 30% that may be classed as agricultural, about one-half could not be made available for agricultural purposes without the expenditure of an amount per acre equal to its highest productive value.

A recent report made for the purpose of advising the legislative committee on agriculture in support of a bill aimed to protect the soil and regulate dredging, declares that there are 200,000 acres of land still available for dredging, one-half of which is capable of yielding as good returns as that already dredged. The report states that the gold dredges have destroyed thousands of acres of the best agricultural lands in California and will continue to destroy unless compelled to desist. Much of which is untrue. There never was a time in the history of gold dredging in California when the proved gold-bearing gravel lands available for dredging exceeded 10% of 200,000 acres. In 1905 the proved ground amounted to about 20,000 acres. In 1911, I made an estimate[1], based on the best authority available in visiting the larger fields, placing the total at 16,600 acres, distributed as follows: Yuba County, 3500; Butte County, 3800; Sacramento County, 5800; eight other counties combined, 3500. Since that I have visited every dredging field in the state except Merced and Trinity Counties. In the last two years a small amount of land was added to the proved territory and a large amount dredged, bringing the total down to approximately 11,000 acres. I estimate that there have been dredged 2000 acres of lands classed as agricultural, and that there remain to be dredged 3000 acres of similar lands.

Some of the land in the Oroville field, classed as agricultural, required an expenditure of $265 per acre to fertilize, without materially enhancing its value. Other land in the same field required a greater expenditure for destroying insects than the fruit crops were worth. In the Folsom field about 100 acres of supposed arable land were planted to fruit, from which no marketable crop was ever harvested. In other counties much of the dredging land classed as agricultural is the poorest of pasture land, while other tracts could not be made valuable for agriculture without drainage or reclamation at a greater expenditure than their highest value would equal; and that could be more economically done after dredging than during the the operation.

California has an area of 155,980 square miles, or 99,827,200 acres, of which 28.9% or 28,828,931 acres are classed as farm lands and 28,605,000 acres as timber lands. Of the farm lands approximately 14,000,000 acres have been improved, and of the timber lands about 5,000,000 acres are held in private ownership, the rest being within the National reserve. As an offset to the loss of about 3000 acres of agricultural land to posterity, there are four important features resulting from the dredging industry that are ignored by the investigator employed by the conservationists and farmers and the advocates of legislation for the protection of the soil and the regulation of dredging: (1) The construction of retaining walls on Yuba River for the protection of Marysville and other towns and farm lands from flood waters; (2) the reclamation of lands permitting the extension and beautifying the town of Oroville and causing the construction of a concrete levee for the protection of the town from the flood waters of Feather River; (3) the reclamation and irrigation of 90,000 acres of lands on the American, Sacramento and Bear Rivers; (4) the establishment of rock-crushing plants in the Natoma and Oroville fields that are turning the gravel tailing into material for concrete and road building. None of these things would have been accomplished by any other industry than gold dredging. Besides these results the gold-dredging industry has produced $50,000,000 in gold, of which amount not 1% would have been produced by agriculture or by any other method of mining from the same lands. The construction of dredges and the manufacturing plants established for their construction represent investments aggregating approximately $10,000,000. The building and operating of gold dredges and rock-crushing plants give employment to 3000 workmen (most of whom are skilled laborers) and 150 engineers and other technical men.

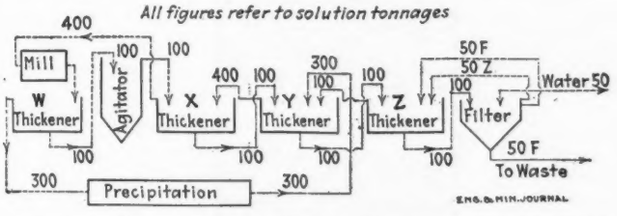
The only feasible and economical method for dredging and reclaiming the land, except in rare instances, is the one now in use in which the tailing gravel is cleared away, the rock crushed for industrial uses, and the soil that has been fallowed by the dredges to a depth of 20 to 60 ft., is leveled, irrigated and made ready for the planting of seed and the harvesting of crops. There are a few rare cases, governed by the topography and structure of the land, where the dredging is done with dredges equipped with flume conveyor for handling the tailing. But this would be impossible on most of the land dredged in California. The slightest study should show that the immense yardage of gravel and soil taken out and turned over by the bucket-elevator dredges where the gravel is of great size, cannot be replaced at the same level; in other words, that it cannot be replaced in the same space from which it was taken. The removal of the surplus rock and the leveling of the land and the placing of the soil on top can be and is being done by the rock-crushing plants. The investigator might have learned all this and reported it. But this is not what he was employed for.

[1] "Eng. and Min. Journ.," July 8, 1911, p. 65.

Continuous Decantation with Dorr Thickeners

By Jesse Simmons*

In the cyanide treatment of ores having such physical properties that the slime pulp may be brought down to about 40% solid matter the continuous-decantation system presents attractive features. Certain clayey ores cannot be brought to this consistency, hence are not suitable to the process, although other clayey ores may be found entirely suitable. A process of continuous decantation utilizing mechanical thickeners made by the firm, is described in a series of leaflets issued by the Dorr Cyanide Machinery Co., of Denver, Colo. The principle of the process relies upon the efficiency of the Dorr thickeners in quickly and cheaply reducing the moisture content of slime pulp from the usual mill consistency of three or four parts solution to one part solid, to a material consisting of one part solution to one part solid. A series of thickeners is installed, the ore passing through them in a given direction, being diluted at each successive thickener with solution from the overflow of the thickener next below. The solids are thus passing in one direction and the solution in the opposite direction. Barren solution and water (the latter in



Typical Flow Sheet of Continuous Decantation System, Using Dorr Thickeners

quantity sufficient to replace the moisture finally discharged with the tailing) are added at the final thickener. The solution, traveling upward, meeting constantly richer pulp, finally is used in the crushing department and is then precipitated.

Thickeners, Agitator and Filter Used

The flow sheet herewith shows a typical arrangement of thickeners, in connection with an agitator and filter for final wash. Assuming the following conditions: 100 tons of ore crushed daily in 400 tons of cyanide solution; $4 dissolved per ton of ore crushed (75% of this solution taking place in the mill and 25% in the agitator); pulp from all thickeners discharged in the ratio of one of solution to one of solid; 300 tons of solution daily precipitated to $0.02; displacement efficiency of filter 75% (that is, 75% of the value of the solution in the solid cake, which is assumed to contain 33⅓% moisture or 50 tons solution to 100 tons solid, is recovered). The 50 *Z* returned from the filter to the last thickener represents 50 tons of solution removed in loading the filter, which will, of course, still have the value of the solution *Z*.

With these conditions, the calculation of the different features of the process are resolved to equations in mathematics, and may be computed with accuracy. Letting, *W*, *X*, *Y*, and *Z* represent values in dollars per ton of solution discharged from the thickeners, and *F* the value per ton of solution discharged from the filter, and equating the value in the overflow and underflow from each thickener, the calculations are as follows:

(1) 300W + 100W = 400X + 100 tons of value $3 that is 400W = 400X + 300
(2) 400X + 100X = 400Y + 100W + 100 tons of $1 that is 500X = 400Y + 100W + 100
(3) 400Y + 100Y = 300 tons value $0.02 + 100X + 100Z that is 500Y = 6 + 100X + 100Z.
(4) 100Z + 100Z = 100Y + 50Z + 50 × 3F that is 150Z = 150F + 100Y.
(5) 50F + 50 × 3F + 50Z = 100Z + 50 Water that is 4F = Z.

Dividing (1) by 4 we get 100W = 100X + 75—Substituting the 100W in (2) 500X = 400Y + 100X + 75 + 100 that is 400X = 400Y + 175—Multiplying (3) by 4 we get 2000Y = 24 + 400X + 400Z and substituting the value of 400X we hav 1600Y = 400Z + 199—Multiplying (4) by 16 we get 2400Z = 2400F + 1600Y—Substituting the value of 1600Y we have 2000Z = 2400F + 199.—Now 2000Z = 8000F from (5), so 5600F = 199, i. e., F = 0.0355357 and Z = 0.142142.

Substituting these values in (4) we have 10Y = 15(0.14214)—15(0.03554) so that Y = 0.1599104.

Substituting these values in (3) we have X = 5 (0.15993)—0.14214—0.06 so that X = 0.597410.

Substituting these values in (1) we have W = X + 0.75 so that W = 1.347410.

As a check to these figures:

The amount precipitated (1.347410—02) 300	= $398.22300
Lost from filter 0.0355357 × 50	= $ 1.77678
Total accounted for	= $399.99978
Discrepancy due to neglected decimals	= $ 0.00022

From the foregoing calculations it may be seen that the assay value of the pregnant solution (value of *W*) is $1.3474, and of discharged solution (value of *F*) $0.0355. Thus the loss of dissolved metal per ton of ore (50/100 of *F*) is $0.0177. The percentage of dissolved metal saved amounts to 99.5 per cent.

Labor and Power Costs Low

Since these results can be accomplished with a minimum consumption of power and labor, for the thickeners, they are extremely interesting. Power consumption figures 0.2 hp. per ton for handling 100 tons per day through four thickeners, with dilutions of 3:1 and the tanks being continuously full, giving a constant static head. As to labor, the care of four tanks can be entrusted to the solution man, who easily can attend to them and his other duties. They are practically automatic in their operation.

Certain modifications of the plant illustrated may be necessary under certain conditions. The case illustrated covers an ore where no gold or silver in the ore is dissolved in the thickeners. Such a solution of the gold and silver, taking place in the thickeners, requires additional agitating tanks, otherwise the underflow will contain dissolved metal of appreciable quantity no matter how far the thickening may be continued. At some mills, notably the Mexican[1], at Virginia City, Nev., the pulp flows from thickener to agitator and back to thickener, through a cycle of three agitators and three thickeners, and finally to an Oliver filter.

In addition to the plant illustrated in the flow sheet, under other conditions the filter may be dispensed with, and possibly the agitator as well. On ores where an exceedingly weak solution will dissolve the metal, and where the pulp can be discharged with a low moisture content, the installation will be successful with thickeners alone, and few in number. Where a stronger solution is required, two or three additional thickeners may be operated at a trifling additional cost. The values dissolved per ton milled are not important, as richer ores will merely need one or two additional thickeners in the series, or else a larger amount of solution precipitated per ton of ore milled.

Three Methods of Installing

Three different general schemes of installing the process are in use. One is to set the thickeners on different

*Deadwood, S. D.

[1]Eng. and Min. Journ., Oct. 12, 1912.

levels, which may be done in two ways, and the other is to set them all upon the same level. If the thickeners are set upon different levels, they may be arranged to allow the underflow to proceed to the next thickener by gravity, or to make allowance for transferring the overflow from thickener to thickener by gravity. In the case of setting the thickeners all upon the same level both underflow and overflow must be handled by power. In the first two methods, the man making the installation must decide which he will handle by power, the underflow of 200 tons of pulp, or the overflow of 400 tons of solution. The pulp and solution may be handled by plunger or diaphragm pumps, or air lifts. From the foregoing it will be seen that the process is chiefly useful in recovering metal which has already been dissolved, and in lessening the mechanical losses of cyanide discharged in the tailing.

Emery and Corundum in 1912

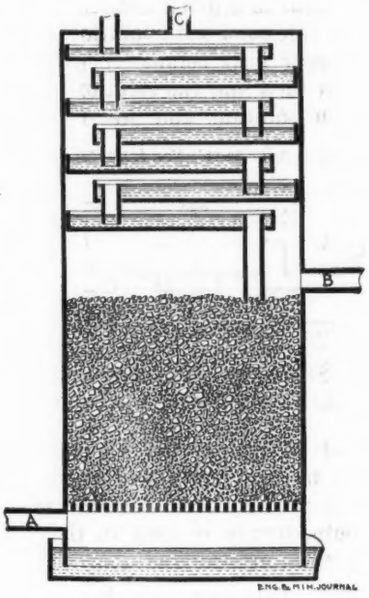
The general condition of the emery and corundum business during 1912 was good, especially for the last three months. H. A. Stiles & Co., of Boston, doubled the capacity of their mill, in which Naxos or Greek corundum is crushed and graded, the yearly capacity of the mill being 3000 tons. During the last two months of 1912 the mill was in operation night and day, reflecting the status of the industry. The artificial abrasives have cut in on some lines of the business, but there are only certain kinds of polishing where they can be used to advantage.

Emery, which term in the market covers common, dark, granular corundum containing more or less magnetite and hematite, is now used, especially in the region of New York, almost to the exclusion of the abrasive usually known in the trade as "corundum." The product designated by this term is extremely irregular in quality; in fact, to such a degree that it is impossible to give a quotation on the material even when a large sample is sent from a mine, for the reason that even in the same deposit the grade varies widely in different places. Shipments are settled upon according to the qualities of the product only after being received by the buyer.

Corundum, which is aluminum oxide, Al_2O_3, and has a hardness of 9, has been mined on a small scale in Gallatin County, Mont.; Rabun County, Ga., and Macon County, N. C., in the United States, but the production of recent years has been nil. The mineral is imported from mines in the Craigmont district, Renfrew County, Ontario. Emery is supplied by mines at Chester, Mass., and Peekskill, N. Y., but the output supplies but a small portion of the quantity of the material consumed. The principal source of supply is the island of Naxos in the Grecian archipelago. The mines are under government control and the production is about 10,000 or 12,000 metric tons annually, the price received being about $20 per metric ton for the coarse "ore," but this price ranges according to the demand. The mineral is also obtained in India, but the exports are not large, although the product commands a fair price. The small sizes or grain corundum is worth about $100 per short ton. The annual consumption of all grades of corundum, including emery, in the United States is baout 12,000 short tons. The preparation of the mineral for the market is a simple operation, consisting of drying, crushing and grading the product of the mines.

Wedge Process for Concentrating Sulphur Dioxide

As is well known, the gases from smelting furnaces and converting plants are not always available for making sulphuric acid, because of the low tenor of sulphur dioxide contained in them. In U. S. pat. 1,046,915, Utley Wedge, of Ardmore, Penn., suggests the following method for obtaining gases in which the sulphur dioxide is concentrated, from the waste gases hitherto mentioned. The apparatus consists of a tower in which a multitude of pans convey water in serpentine fashion from top to bottom, the bottom of the tower being packed with broken brick, stone or other porous material, which breaks up the flow of water completely.



SO_2 Concentrator

Gases enter at *A* and are drawn off at *B* and *C*. The effluent gas from *C* having passed over the successively cooler portions of water contained in the pans, which absorb the sulphur dioxide; is almost completely free from it, while the water having been heated by the successive pans and by counter passage through the broken stone, against the incoming hot-gas current, completely discharges the sulphur dioxide, thereby enriching that portion of the gas drawn off at *B*. The lower ends of the drain pipes from one pan to the next are submerged in order that the water may not be disturbed and so made to give off the dissolved gases. The solvent power of the fresh water is greatest where the SO_2 tenor of the gas is least.

A Timber Preservative will be applied to the fenders for the lock approaches on the Panama Canal. Although the intention was to use oak for the purpose, because of the excessive cost of both this and yellow pine, it was found advisable to adopt Douglas fir. About 550,000 ft. b.m. will be needed and the price will be $34.30 per M. As the climate and the insects of Panama are very destructive, the timbers will be treated with Avenarius Carbolineum. The liquid will be heated to 190° F. by a steam coil in a tank 4x4x20 ft., and the timbers immersed one at a time and allowed to remain for 30 minutes.

EDITORIALS

The Hawthorne Verdict

The verdict in the Hawthorne case, rendered last week, brings the government almost to the conclusion of its campaign against the fraudulent promoters of mining and petroleum stocks, bucket-shop conductors, and get-rich-quick gentry of all kinds, a campaign in which the JOURNAL has taken a prominent part, as also have some of the great dailies, especially the New York *Sun*, which not only has always refused to prostitute its advertising pages to the allurements of the fakers, but also has time and again exposed them in its editorial columns. The *Sun* has shone the more in this, inasmuch as many of its daily contemporaries have been in a way side-partners in the crime, sharing through their counting-rooms in the plundering of the ignorant public. The disappearance of that kind of advertising, since its unhealthfulness (both to offerer and accepter) became manifest, is noteworthy.

The government has now won all of its cases except the Wisner case, in which the jury disagreed, receiving a scathing rebuke from the judge. We understand that the government will retry that case with no fear respecting the result.

The Hawthorne case was spectacular because of the prominence of three of the four men at the bar. They were not men of uncertain antecedents, but were men of distinguished New England ancestry: Josiah Quincy, the head of an historic family, himself twice mayor of Boston and formerly assistant Secretary of State, at Washington; Julian Hawthorne, son of America's great and dearly beloved novelist, himself a writer of distinction; Doctor Morton, a distinguished physician and the son of the discoverer of ether anesthesia. The suffering that these men now experience cannot fail to excite pity, but their swindling of many poor people who could ill afford to lose their money also produced suffering and excites pity, and the law does not absolve transgressors just because they bear honored names.

Hawthorne and Morton might have been excused five years ago. Apparently they fell into the hands of Albert Freeman, a notorious schemer, who, standing in the background pulled the wires for the malodorous King Solomon and the United mining companies before he turned his hand to the Hawthorne promotions. A literary man and a medical man, unversed in the guiles of such a plotter, might be taken in just as were the admirals in other enterprises of his, but after the exposures by ourselves and by the *Sun*, and after the letters they received from many engineers, they could not be under any honest illusion. Poor Hawthorne was, no doubt, a good deal of a puppet throughout. The evidence in the case was presented with such fullness that all the facts are known. Probably the jury rendered its verdict with reluctance, but if its verdict had been anything else, or if sentence had been suspended, public opinion and the rights of the public would have been outraged.

The result of the government campaign, now so nearly drawing to conclusion, will put the fear of the Lord into the fraudulent promoters more than will any number of "blue sky" laws, and will show the artist who knows how to steer close to the wind that he is no safer than the simple crook who sells bars of gilded lead. It will be useless for them to run their swindling schemes, taking the chance that it is always difficult legally to prove knowledge and willfulness in fraud, and protract trials in the courts on the plea that they thought they were offering good mines at reasonable prices, but were, alas! mistaken and disappointed and were very sorry about it. They know, and their lawyers know, just as everybody of experience knows, that the real mining business is not conducted in their way. If the Hawthorne case had been referred to a committee of experienced mining engineers, the trial would have lasted just about one day.

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The Supply of Iron Ore

James Gayley, distinguished metallurgical engineer and inventor, former vice-president of the U. S. Steel Corporation, has been for a week or so on the witness stand in the Government's suit for the dissolution of the Steel Corporation. We have not followed all of Mr. Gayley's testimony, but whatever it may have been it must have been enlightening to the court and the counsel for the respective sides to whom was it given the rare good fortune to hear from an experienced and expert engineer. We noticed his testimony with respect to iron ore supplies given on Mar. 7 and this is worth reproduction. Mr. Gayley was asked what ore deposits were available if a new steel company should go into business on a large scale. He said:

If it were on the Atlantic seaboard, it would have deposits in northern New York to draw from, for one source. There are large deposits in the Adirondacks that have only been scratched. There are others in Nova Scotia, with cheap water transportation. There is more ore in Cuba than in the entire Minnesota district. Deposits in Brazil are enormous. Estimates by engineers are so large as to be astounding, running to 1,000,000,000 tons, if not more. The Bethlehem Steel Co. is already getting ore from Sweden.

Suppose the new company located on the Great Lakes? suggested Mr. Severance.

It could get plenty of ore from the Western Mesabi, from the Baraboo district in Wisconsin, and from the Witherbee-Sherman mines in northern New York. The quality of the New York ore is the finest in the world and the quantity is enormous. This deposit is just beginning to be worked.

In Utah there are deposits of from 300,000,000 to 500,000,000 tons, with coking coal easily accessible. Limestone, the other factor in making pig iron, is found everywhere, and Utah is so situated as to be able to support a self-contained steel industry.

On the Pacific there are large deposits in Lower California, and when the Panama Canal is opened cheap coal will be available. In Texas there are rich deposits to support a steel industry there, with coal economically available from Alabama.

Do you know of any other commercial reason why these deposits are not developed?

Simply a lack of consumption of steel in sufficient quantities in the West and Southwest, so that the demand can be more economically supplied from the present plants.

The above is, of course, what is well-known to engineers. We have many times forecasted the development

of a great steel industry on the Atlantic seaboard. This will surely come to pass, sooner or later. Already plans are being carried out for steel making in Texas. There is no monopoly in iron ore or coal. Opportunity awaits enterprising capital. If it knocks in vain at the door there can surely be no blame laid to the U. S. Steel Corporation or any other trust, not even the "money trust" of Mr. Pujo and Mr. Untermyer.

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The Diesel Engine in Mining

It is news of more than passing interest that Phelps, Dodge & Co. is going to install two Diesel engines of 1000 hp. each at one of its properties. The Diesel engine has proved a highly economical power producer in European practice, where it has attained a far wider use than in the United States, but a great application of it will no doubt be witnessed in this country also in the course of time. Particularly do we foresee for it a great usefulness in those mining regions west of the Rocky Mountains where coal is dear and electric power is unavailable, while oil is relatively cheap, as, for example, at many places in Arizona, New Mexico and Nevada.

A distinguished engineer who installed an immense power plant at the mine in the West that is under his direction, and who has had lately an opportunity to study the Diesel engine in Europe, told us not long ago that if he had known so much when he put in his plant as he does now, he would have put in Diesel engines and he will seriously consider using that type in any extension that may be necessary, notwithstanding that such will result in a mixed plant.

The Diesel engines that are to be furnished to Phelps, Dodge & Co. are guaranteed to deliver a brake horsepower from the use of not more than 0.48 lb. of oil. It is an extraordinarily good steam plant that will produce a horsepower on much less than a pound of oil.

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Refining at Pittsburgh-Silver Peak Mill

Detailed information concerning the final operations in the cyanide process are somewhat meager. We are, therefore, pleased to present in this issue the excellent article by Lyon Smith, which gives a full account of the cleanup and refining methods employed at the Pittsburgh-Silver Peak mill.

In considering the procedure at this mill, it will be noted that it combines some features of the usual method, employing acid treatment followed by crucible melting, and of the Taverner process, which consists of smelting the precipitate, direct from the boxes, with suitable fluxes to produce lead bullion for subsequent cupellation.

If we take the practice in Mexico and Tonopah as a criterion, we conclude that for silver precipitate direct melting in crucibles is the most feasible method. For the refining of gold precipitate, however, preliminary acid treatment is still considered essential if losses by volatilization in subsequent crucible melting are to be avoided and if a high-grade bullion is to be produced. The Taverner method provides for the elimination of the objectionable acid treatment and claims the advantages of lower melting cost and less loss of precious metals.

At the Pittsburgh-Silver Peak the zinc-dust precipitate is acid treated, dried, briquetted and charged to a blast furnace where the precious metals are collected as lead bullion, as a preliminary to cupellation. There is no doubt that after the application of acid treatment and water washes the precipitate furnishes excellent material for efficient smelting. Whether the elimination of acid treatment would result in losses greater than the cost of such treatment would be an important factor in deciding whether the procedure could be simplified. The total cost for precipitation and refining at this mill is given as $0.08 per ton of ore treated. While there are mills at which the cost for this item is lower, the conditions are not analogous, so comparisons under these circumstances would obviously be unfair.

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Steel Trade Conditions

The monthly reports of unfilled orders issued by the Steel Corporation have come to be considered as barometers of the conditions in the steel trade. This is correct within certain limitations, but its force is weakened by the rather loose conditions of many contracts, which are, in effect, rather options to take a certain quantity of material within a certain time than strict obligations to do so. Efforts have been made to enforce stricter conditions, but with only partial success. The Steel Corporation, however, is usually more rigid in its terms than most of its rivals, though it is still uncertain how much business not actually specified is included in its reports of unfilled orders. The figures given out last week for Feb. 28 show the first recession for several months past. The total unfilled orders on that date amounted to 7,656,704 tons, and this was a loss of 170,054 tons from Jan. 31; but it was 2,202,504 tons greater than the total for Feb. 28, 1912. The change for the month is very small, and its only significance is that the deliveries of material for the month were greater than new orders or specifications received by that small amount. The loss, in fact, is much less than was expected. The mills have generally been able to work steadily, owing to absence of severe cold and snowstorms, and the natural period of quiet, following the rush of orders in December, has not yet passed.

Upon the whole, the steel trade seems to be in sound condition, with fair prospects of continued activity for some time to come. The demand for materials of construction does not appear to be satisfied by any means. New building of all sort, small and large, is still in progress or planned on a scale which will absorb a very large share of all that the mills can supply. We hear now and then some hesitation expressed about the future, but it is noticeable that all the large companies are making most liberal provision of raw material for the coming year.

Rather singularly the pig-iron market has been subject to much more fluctuation and uncertainty than that for finished steel. It must be remembered, however, that the open market—which is for foundry and forge iron largely —does not cover more than 30% of the iron made; the remaining 70% being made by the steel companies and not really entering the market at all, until it appears as finished steel. The open market for pig iron has been disturbed by two causes: the speculation in coke, which forced the prices of that fuel up to an unreasonable point —which it has failed to hold; and more recently the liquidation of speculative contracts, which were entered into some months ago, when prices of pig iron were almost

at the lowest point. Both these disturbing influences have largely disappeared, or are disappearing.

Now and then we hear some talk of business disturbance from steel-tariff revision, but this is not to be too seriously taken. Reductions in the steel tariff rates will probably be made, but they cannot seriously affect business. In fact, in the present condition of the British and German trades the ocean freight rates alone would be enough to prevent any large imports. Even should our rivals try to push material on us, it would at the most serve only to prevent increases in price beyond a certain point. Unless there is a break in the markets abroad, even the entire abolition of the tariff could hardly induce large imports at the present time. The extension of our own buying and building power through another year by good crops is far more important to the trade than any possible or probable tariff changes.

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Low Costs and Safety

To most readers, Mr. Hibbert's description in this issue of mining methods and costs at the Mother Lode mine will be chiefly remarkable for the low costs obtained. To be sure, while the ore must be hoisted, the depth is not great and no pumping expense is mentioned; also there are no development costs included, nor fixed charges on the plant. Nevertheless to put the broken ore on the cars for $0.57 per ton is a real achievement, especially in view of the rather moderate scale of work; and while conditions are extremely favorable for cheap operations, full advantage has been taken of these conditions, which is after all, the essence of good mining

Less remarkable at first thought perhaps, but really more extraordinary, is the fact that, not only are low costs found not incompatible with safety for the men underground, but it was even considerations of safety that were largely responsible for adopting the methods used. A back, low and exposed in narrow areas only, reduces greatly the danger from fallen rock, and electrical firing applied to over half the ore almost eliminates the possibility of delayed blasts and cuts down largely the number of misfires.

There are many mines handling a large, low-grade orebody where such a consideration as increased danger to the men is not allowed to stand in the way of low-cost mining. It may be that the element of safety affects the cost sheet to an unsuspected degree, since intelligent, efficient and reliable men tend to concentrate at mines where they are not compelled to undergo unusual risks and will furthermore deliver more work when unharassed by the thought of possible accident. But there is no such way of making dangerous methods obviously expensive as the adoption and enforcement of an effective employers' liability law.

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The latest accident on the New York aqueduct took place the morning of Mar. 6, in a heading from one of the shafts. Luigi Bardelio, the foreman, was killed, and Dominick Sisetera and George Rego, laborers, were injured by a fall of rock. The aqueduct manages to keep adding to its score. We suggest that in the names of the men can be found a clue to the cause of the accident. If the foreman had been Samuel Trebilcock, and his assistants Patrick O'Brien and William Jones, probably the accident would not have occurred.

BY THE WAY

A mechanical engineer, prominently connected with the design and construction of milling devices, is responsible for the statement that the term "flow sheet," as applied in milling for designating the diagrammatic portrayal of a metallurgical treatment, has been adapted from the flour-milling industry, in which the system has been in use for many years.

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The necessity of knowing at least a little about the mining business before investing heavily is suggested by the following story sent us by an engineer in Honduras: A prospector had brought in a sample of supposedly rich gold ore for examination by an assayer. On being informed later that it was nothing but iron pyrites and not worth a cent, the astounded prospector exclaimed in direst dismay: "Good Lord! there is an old woman up our way who owns a hill of it, and I married her."

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The special-delivery system was added to the parcels-post mail service on Mar. 1. The same rules apply as in letter mail, namely, the addition of a special-delivery stamp, or of 10c. in regular postage stamps (not parcels-post stamps) and the words "Special Delivery." Announcement has been made in the daily press that the C.O.D. feature is to be added to the parcels-post service on July 1. The official rules have not been announced, but it is stated that for an additional 10c. in parcels-post stamps, a package will be delivered and the collection made from the addressee for the amount marked on the package.

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Few people thought of the late E. H. Harriman as being interested in mining, yet his mining investments amounted to well over a million dollars. His holdings in Greene-Cananea are valued at about $900,000 and he was also an important stockholder in Golden Reward, and to a lesser extent in Nipissing and Braden Copper; in Golden Reward, he had 281,628 shares; in Nipissing, 7000 shares; Braden, 10,000. He was also interested in a number of coal and iron companies. As in the case of most rich men, Mr. Harriman had some mining shares that will cause mining engineers wonderment, both as to the situation of the properties and to how rich men are induced to buy such shares. Doubtless a great many promoters would also like to have the key to the latter mystery. Among the mining "cats and dogs," listed in the estate holdings as of no value, are: Trophy Mining Co., 1000 shares; Mt. Pleasant Gold, 1000; Union Consolidated Silver, 100; Bear Valley Gold, 25 shares. There were other classes of "no value" shares, however, such as Safety Train Signal Co., New York Typewriter Co., Depew Improvement Co., Laclede Construction Co., Colonial Sugar Co., etc. The worthless stocks were in small blocks and contrast strongly with the large holdings in important companies. The official inheritance-tax appraisal filed this week placed the value of the estate at the time of Mr. Harriman's death, in September, 1909, at nearly $70,000,000, but the value of the holdings have shrunk so that, on the basis of today's prices, the estate is valued somewhat under $60,000,000.

PERSONALS

C. H. Macnutt has returned to London.

S. W. Mudd, of Los Angeles, Calif., has been in New York attending the marriage of his son.

L. C. Graton has been elected to membership in the Mining and Metallurgical Society of America.

H. V. Winchell sailed on Mar. 22 for Argentina, where he will be engaged for about two months.

S. F. Shaw has been obliged to leave Charcas, Mexico, on account of disturbed conditions there, and is now at Mexico City.

W. H. Case, of El Paso, Texas, has been appointed manager of the Hazel Mining & Milling Co., and is now in active charge.

George G. Crawford, president of the Tennessee Coal, Iron & R.R. Co., has returned to Birmingham, Ala., from a trip to Panama.

F. W. Ridley, superintendent of the Allouez and Centennial mines, has returned to Calumet, Mich., after an extended European tour.

Waldemar Lindgren has returned to Boston, having finished an examination of mines at Zimapan in the state of Hidalgo, Mexico.

J. S. C. Wells sailed from New York, March 18, for Santo Domingo, on professional business. He expects to return about the first of July.

R. L. Lloyd having finished the installation of a Dwight-Lloyd roasting plant at Cerro de Pasco, Peru, has started on his return journey to the United States.

E. H. Webster has resigned as assistant manager of the Motherlode Sheep Creek Mining Co., British Columbia, and is returning to Los Angeles, Calif., in April.

Kirby Thomas has returned to New York from a professional trip to Arizona and New Mexico, and has gone to Port Henry, N. Y., to examine iron properties.

Dr. H. M. Chance has gone to Northeastern Texas to make an examination of iron-ore deposits and probably will be absent from Philadelphia about a fortnight.

J. W. Finch, who has been in New York for about four months, advising the Government in its prosecution of the Hawthorne case, has now returned to Denver.

L. D. Davenport, recently chief engineer for the Oliver Iron Mining Co. at Mesaba, Minn., is now engineer for the Ernestine Mining Co. at Mogollon, New Mexico.

A dispatch from Goldfield, Nev., reports that Albert Burch has been appointed superintendent of the Goldfield Consolidated Mining Co., in place of J. F. Thorn, resigned.

Robert D. Hennen and G. H. Hartley have organized the Monongahela Valley Engineering Co. at Morgantown, W. Va., and will do business as civil and mining engineers.

Charles F. Schwarz is now in charge of the operations of the Cerillos Mining & Smelting Co., at Cerillos, N. M. He has been for some years employed at Joplin and in the Southeast Missouri district.

Dr. Kotora Jimbo, professor of Mineralogy in the University of Tokyo, Japan, arived in New York, March 12. He is on his way from Europe to Japan, and spends several days in visiting Columbia University.

William C. Springer, formerly with the Milwaukee Solvay Coke Co., is now superintendent of the byproduct coke plant which the Northwestern Iron Co. is building at Mayville, Wis. He has charge of construction at present.

Geo. D. McClellan is now mine inspector for South Dakota, having been appointed by Gov. Byrne. The term is two years. Mr. McClellan has been a resident of the Black Hills district for a number of years, and up to about Jan. 1 held important minor positions at the Homestake mines.

Prof. H. O. Hofman of the Massachusetts Institute of Technology, has been appointed metallurgical examiner for the United States Civil Service Commission. It will be his duty to compare the qualifications of candidates for metallurgical positions in the government service and to rate them accordingly.

Goldthwaite H. Dorr, Assistant U. S. District Attorney at New York, who has been in charge of the Government's case against Freeman, Hawthorne, Morton and Quincy, which he has just brought to a successful conclusion, is a brother of J. V. N. Dorr, the well known mining and metallurgical engineer of Denver, Colo.

James L. Bruce, who has been manager for the Continental Zinc Co., at Joplin, Mo., for the last five years, is to be manager for the Butte & Superior at Butte, Mont. He will continue to be general manager for the Continental Zinc Co., but will be succeeded at Joplin by R. T. Munson, who has previously been in charge of one of the Continental mines. Both the Continental and the Butte & Superior are Hayden-Stone companies.

Dr. L. D. Ricketts will retire on April 1 from the direct management of the Cananea Consolidated Copper Co. at Cananea, Mex., and will become president and consulting engineer of the company. He will continue to make his headquarters at Cananea, but he will spend a good deal of his time in other places. It is in fact the multiplicity of his duties that has led to this change. Doctor Ricketts will be succeeded as general manager by James S. Douglas, formerly manager at Nacozári for the Moctezuma Copper Co.

OBITUARY

F. C. Earle died recently. He was formerly for some time manager of the smelting works at El Paso, Texas, and before that had lived at Tucson. He was widely known among mining men in Arizona and Mexico.

Alexander H. Sherrerd died at his home at Newark, N. J., Mar. 14, aged 53 years. He was a mining engineer and had been for a number of years connected with the Lackawanna Iron & Coal Co., at Scranton and elsewhere.

George E. Gunn, who died in Salt Lake, Utah, Mar. 11, was well known in Utah as a mining engineer and promoter. He was a partner in the Gunn-Thompson Co. and was an early believer in the porphyry copper properties He made a good share of his substantial fortune in the porphyry stocks. A longer notice will appear in our next issue.

Friedrich Schniewind died Mar. 12, at his home at Englewood, N. J., aged 52 years. He was born in Germany and came to this country when 28 years old. He was educated at Heidelberg and received the degree of Ph.D. He was a pioneer in the byproduct coke-oven business and was first to introduce such an oven into this country. At the time of his death he was president and owner of the German-American Coke & Gas Co., and its subsidiaries, the United Coke & Gas Co., and the Coke & Gas Construction Co. Dr. Schniewind was a chemist of high attainments and great ability, a man of quick insight and a hard worker We expect to publish a longer obituary in our next issue.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALUMINUM—Process for the Manufacture of Aluminum Nitride. Soc. Generale des Nitrures, Paris, France. (Brit. No. 22,435 of 1912.)

PLATINUM—Alloy of Platinum and Osmium. Fritz Zimmermann, Newark, N. J., assignor to Baker & Co., Newark, N. J. (U. S. No. 1,055,119; Mar. 4, 1913.)

ZINC—Electrolytic Recovery of Zinc and Manganese. Andrew Gordon French, Nelson, B. C. (U. S. Nos. 1,055,157 and 1,055,158; Mar. 4, 1913.)

ZINC—Retort Press. Charles Albert Wettengel, St. Louis, Mo. (U. S. No. 1,054,064; Feb. 25, 1913.

DRILL CHUCK. Ivar F. Lindberg, Milwaukee, Wis. (U. S. No. 1,054,126; Feb. 25, 1913.)

DRILL EXTRACTOR. William L. Hatzel and Theodore Stoetzel, New York, N. Y. (U. S. No. 1,055,169; Mar. 4, 1913.)

DRILLS—Improvements in Hammer Drills. J. M. Holman and J. L. Holman, Camborne, Cornwall, Eng. (Brit. No. 2134 of 1912.)

HOISTING—Safety Device for the Cages of Lifts and Hoists. Arthur Gardner Huling, La Salle, Ill. (U. S. No. 1,055,179; Mar. 4, 1913.)

MINER'S LAMP. Alexander Leonard Tombelaine, Villanuova-Minas, Spain. (U. S. No. 1,055,001; Mar. 4, 1913.)

CRUSHER. Arthur Niedermeyer and Richard Bernhard, Milwaukee, Wis., assignors to Power & Mining Machinery Co., Jersey City, N. J. (U. S. No. 1,054,135; Feb. 25, 1913.)

CLASSIFIER—Combined Ore Classifier and Jig. Hammond C. Gilbert, Denver, Colo. (U. S. No. 1,055,737; Mar. 11, 1913.)

PULVERIZER. Milton F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,055,686; Mar. 11, 1913.)

ROASTING—Improvements in or Relating to Mechanical Ore-Roasting Furnaces. John Harris, Darnall, Eng. (Brit. No. 7727 of 1912.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Mar. 12

The Appointment of Franklin K. Lane as Secretary of the Interior is generally approved in this state, especially by mining men who desire the prosperity of the industry and fairness to the prospector and miner of small means. There has been much compiaint by locators of mining claims against the policy of the Department of Interior and in many instances the complaints were based on good grounds. In fact the conservationists and the farmers have had all the best of it in nearly every instance of controversy over the location of mining claims and homesteads. The general land office has often seemed to be wanting in fairness to the mining men and the industry. Secretary Lane is a Californian, and has the oportunity to remedy many of the evils for which his predecessor was held responsible by the miners of California. These evils have largely been the result of the employment in the local land offices of subordinates either ignorant of mineral matters or intentionally unfair to the miner. A shaking up of the field agents will cure this evil.

The Discovery of Gold in Alum Rock Cañon near San José is not of sufficient importance to attract investors or intelligent prospectors. Most of the locations, and probably all of them, are within Spanish grants, which are not open to legal mineral location as on the public domain. The situation of the first of the claims located is in the mouth of the cañon, or gulch, which is the entrance to a public park controlled by the park commissioners of San José. The Peninsula Electric Ry. is being extended through the cañon to the park to provide quick transportation and make the park an outing place for the residents of the towns and the fruit ranches in the Santa Clara valley. The steam shovel operated by the railroad builders cut the formation along the southern side of the cañon and exposed irregular masses and fragments of sandstone, serpentine, quartz, and conglomerate. The local newspapers reported that the ore assayed $45 per ton, and a small stampede was started. One sample assayed $5.18 and others 20c. per ton. The cañon is about 20 miles northeast of the Almaden and Guadalupe quicksilver mines and at the northerly termination of the serpentine belt with which the cinnabars ores are associated. No commercially valuable gold ore has ever been discovered in this belt. Ordinarily reports of discoveries of this character are not worth investigating, but California just now is afflicted with an apparently sincere and evidently honest class of mining promoters, without any practical knowledge of mining, who are following in the wake of the fake promoters that harassed the state for years.

Potash Reserve No. 2, California, Has Been Created by order of the President issued Feb. 21, 1913, directing the withdrawal of lands in northern San Bernardino and southern Inyo Counties. This reserve is in the Independence land office district in the Borax Lake region, including the Searles Lake deposits. It embraces 720 acres in Sec. 22, 33, 34, 35, T. 24 S., R. 43 E.; M. D. M.; also an unsurveyed area in the same township in Inyo County and extending into T. 25 in San Bernardino County, 12 miles south and 9 miles east. The total area is 69,840 acres. This reserve includes the deposits of the California Trona Co., and while the withdrawal order does not specify the exception of valid claims filed, the rights of the company are believed to be recognized. A full investigation will be made by F. C. Dezendorf, chief of the second division of the general land office. This is the second potash reserve created by Presidential order. The first is in Nevada near the town of Coalville. It is reported that the Searles Lake potash deposits will be developed in the coming season by the Foreign Mines Development Co. Guy Wilkinson, manager, is at present in London in the interest of the proposed development. The discovery, location, operation and partial development of the Searles Lake deposits has attracted a great deal of attention and made an interesting chapter in the mining history of California, which was written by C. E. Dolbear the discoverer and published in the "Journal" of Feb. 1, 1913. The litigation which retarded the development was practically ended in December, 1912, and the California Trona Co. subsequently filed affidavits of labor, completing its title to the property. The favorable action of the land office which is expected to follow the withdrawal order of President Taft, will place the operators in position to develop and produce potash without further intereference.

DENVER—Mar. 14

The Smuggler Union vs. Liberty Bell Suit for compensation for the ore removed from Smuggler-Union ground by the Liberty Bell Co., resulted in damages of $403,000 being awarded the complainant company in the Colorado Federal court, which judgment has been affirmed by the U. S. Circuit Court of Appeals at St. Louis, Mo.

The International & Northwestern Asbestos Companies were to be reorganized at a meeting held in Cheyenne, Mar. 12. It is the intention of the reorganizers to reduce the capitalization of the two from $25,000,000 to $8,000,000. The properties are near Casper, Wyo. Roland G. Parvin, secretary and treasurer of the Union Deposit & Trust Co. is at the head of the syndicate. It is said that ample funds have been promised to place the properties on a business footing again. The company's main office is in Denver, Colo., and through the wide amount of notoriety it has obtained both locally and by action of the U. S. Court, it is to be hoped that the new management will place it on a commercial basis.

In the Doctor-Jack Pot vs. Work Mining & Milling Co. suit, a jury of the U. S. District Court is hearing evidence in order to determine the amount of damages the Doctor-Jack Pot Co. is entitled to for removal of ore from its property in the Cripple Creek district. The case comes up through orders of the Circuit Court of Appeals, which handed down the opinion that the Doctor-Jack Pot is entitled to damages for the ore removed by the Work company, but the amount is for the jury to determine. The Doctor-Jack Pot is claim- the Work company is insisting that it is a much smaller amount. Attorney W. V. Hodges is representing the Doctor-Jack Pot and Thomas, Bryant, Nye & Malburn the Work company.

The Annual Meeting of the El Paso company was held recently at Denver, when nearly seven-eighths of the outstanding stock was represented. Allen L. Burris, president of the company announced in his report that the Colorado Mines, Railway & Utilities Co., which is the name of the company formed to finance the merger of the El Paso, Golden Cycle and other properties, would soon make offers to individuals for the sale of their El Paso stock. He added that negotiations for the purchase of the Golden Cycle were progressing satisfactorily. All the property is reached by the Roosevelt drainage tunnel, the company contemplating a tunnel 700 ft. below this bore; estimated cost $3,000,000. Allen L. Burris was reëlected president, as were all the other officers and directors with the exception of L. L. Aitken, who was succeeded by Richard A. Parker, the company's new engineer. The board as now constituted is: Allen L. Burris, Charles M. Heberton, J. C. Helm, Albert Ehinger, W. M. Downing, W. W. Grant, Richard A. Parker, Horace Heath, A. C. Gardner. President Burris announced the declaration by the board of directors of a 12½c. dividend, amounting to $61,250. Books of the company were to remain open until Mar. 17, for the transfer of stock. The dividend is payable Mar. 31. This will make a total disbursement to date of $1,658,545. This is the first quarterly dividend period of 1913, and the company contemplates a regular quarterly distribution, according to President Burris.

ST. LOUIS—Mar. 14

The Valuation of the Doe Run and St. Joseph mines being made by J. R. Finlay, assisted by G. W. Crane, formerly of the Missouri Geological Survey, with reference to a proposed consolidation, is being completed. The question of consolidation of these two companies operating in the Flat River district will be considered at the meetings soon to be held. Consolidation is recognized as desirable as it will simplify the management and effect important economies in administration. The smeltery of the St. Joseph Lead Co., at Herculaneum, is being equipped with dust chambers.

The Pierson Creek "Gumbo" Mines in southwestern Missouri, yielded more than $100,000 worth of zinc and lead ore in 1912. Most of this came from the Bray mine, formerly known as the Daisy. The Badger resumed operations during the year and produced some ore. A new shaft on the old Nathalia ground was opened and some drilling of this

tract is being done. This property was an extensive producer in 1892 to 1896 and is credited with a total output worth $1,000,000. The Bray mine has to its credit to date about $350,000 output. Benjamin Schnerle, of Kansas City, is drilling between the Badger run and the old Wolverine which adjoins the Nathalia on the north. It is from the Phelps "runs" adjoining the Bray on the south that Schoolcraft is supposed to have extracted lead ore in 1819 and shipped it to St. Louis. In this district the ore is found in a putty-like drab, clay called "gumbo"; formed from the alteration of the impure white limestone bed immediately beneath the Hannibal shale. The shale is unbroken and furnished an impervious roof for the impounding of mineral-laden solutions. Below the limestone bed in which the ore occurs is a thick series of siliceous magnesian beds in which zinc is found in cracks and seams to a depth of at least 100 ft. So far no explorations have found any commercial deposits in these magnesian beds. The "runs" in the "gumbo" are 12 to 14 ft. high and 80 ft. or more wide in places, although about 20 ft. is the average. They are from 1300 to 2000 ft. long and four are known extending to the northwest in a series of steps perhaps indicating extensive lateral faulting. In 1912 the concentrates from the Bray mine averaged 63.6% zinc and 83% lead. About 9% zinc and 1.19% lead, is recovered from the dirt.

Shipments by the St. Francois Lead Co., the new Boston company that is operating the former Jake Day land, have been begun to the mill of the National Lead Co., at Flat River, as the railroad spur has been completed to the St. Francois company's shaft. Five cars per day will be shippel at present, to be followed by larger shipments when the mine is opened up. The ore is shipped over the Mississippi River & Bonne Terre Ry. via Bonne Terre, Leadwood branch. This is the youngest mine of the district, although the orebody was discovered with the diamond drill more than 10 years ago.

SALT LAKE CITY—Mar. 12

Deposits of Marble in Beaver County are owned by the Utah Marble & Construction Co., in which, according to Prof. F. J. Pack, of the University of Utah, there are large quantities of marble, which may be quarried in blocks of any desired size. The material is white, close-grained and compact. The quality is good, comparing favorably with European statuary marbles. The rock is durable, and capable of withstanding weathering. This company will bid on furnishing marble for the exterior of the new capitol building to be erected in Salt Lake City. Utah is rich in marble deposits, there being gray, black, pink, and birds-eye marble in various parts of the state. The quarries have not yet been opened extensively.

NEGAUNEE, MICH.—Mar. 12

The Shipments from the Marquette Range in 1912 were 4,202,308 tons of iron ore as compared to 2,833,116 tons in 1911, a gain of 1,369,192 tons. Most of this gain came from the mines of the Cleveland-Cliffs Iron Co. For instance the Cleveland-Cliffs group in Ishpeming shipped 1,004,684 tons as compared to 344,950 tons in 1911. The company's Negaunee mine shipped 446,318 tons as compared to 140,406 tons in 1911, and in the Gwinn district the Stephenson and Princeton shipped 214,386 tons and 162,138 tons respectively, as compared to 128,839 tons and 27,962 tons in 1911. The Oliver Iron Mining Co. showed a small increase, as its Lake Superior group increased to 219,673 from 174,959 tons, and its Queen group at Negaunee increased to 351,916 from 297,675 tons. On the other hand the Breitung-Kaufman mines declined a little; their Mary Charlotte mine dropped to 260,801 from 343,434 tons, and the Breitung-Hematite dropped to 122,320 from 139,582 tons. The old Lake Angeline mine of Jones & Laughlin, which formerly shipped as high as 400,000 tons in a season, but is now said to be nearly exhausted, dropped to 151,910 from 167,258 tons; but the Rolling Mill mine of the same company increased to 115,784 from 96,585 tons. The Republic Iron & Steel Co. made a small gain by shipping the Lillie stockpile, but was a light operator during both years. In general the low-grade mines were idle or worked only in a small way, while high-grade ore was in strong demand. In contrast to other low-grade mines the Richmond mine of M. A. Hanna & Co., on the Cascade range, made its record production since its opening in 1896, shipping 118,554 tons of ore containing about 40% iron and 40% silica. The Morris mine of the Cleveland-Cliffs Iron Co. at North Lake was the only new shipper on the range.

QUEBEC—Mar. 15

The Black Lake Asbestos First and Final Dividend at the rate of 14.82% has been declared for the bondholders of the Black Lake Consolidated Asbestos Co., Ltd., who did not accept the plan of reorganization approved by the majority of bondholders. The declaration of the dividend is apparently the final act in the affairs of the old company. The reorganized company, under the name of the Black Lake Asbestos & Chrome Co., has taken over the property and is now exchanging the securities of the old for those of the new company. Out of a total of $1,230,000 outstanding bonds, only $39,000 were not turned in. The Black Lake company defaulted on its coupon payments in March, 1912. After the usual three months interval, the bondholders came into possession of the property last summer. The National Securities Co. put the property up for auction and it was bought in by the bondholder's committee for $185,000. The dividend of 14.82% is payable to the bondholders who did not participate in the reorganization agreement. The reorganization plan, of which the majority of the bondholders availed themselves, provided for an equal exchange of bonds, preferred shares and common shares of the old company into corresponding securities of the new company, but the bonds of the old company were assessed 10%, preferred shares 5% and common shares, 2%. One idea of this plan was to give the holders of this stock some opportunity of salvage and not to eliminate their interest entirely. In addition to the $1,230,000 bonds, the old company had a capital of $1,000,000 preferred stock and $3,000,000 common.

PORCUPINE—Mar. 15

Clashes Between the Strikers and the Miners following the withdrawal of the provincial police have recently occurred. A few days ago, two men working at the North Dome mine were badly beaten by strikers and one of them is in a rather serious condition. Recently a large number of miners, incensed at the action of the strikers, started out to retaliate and as a precautionary measure, the mayor of Timmins read the Riot Act. It is hoped that this will have some influence. The superintendent of the provincial police has detailed several officers to return to Porcupine to keep order.

CHIHUAHUA—Mar. 10

Mining Conditions Have Been Chaotic throughout Northern Mexico during the last 30 days on account of the happenings in Mexico City, but since the inauguration of the Diaz-Huerta regime, there has been some improvement. Railway communication has been fairly regular except for temporary interruptions south of Chihuahua, and progress has been made in the reconstruction of the Mexico Northwestern line from Chihuahua to El Paso via Madera. Inasmuch as practically all of the rebel leaders are more or less in accord with the new provisional government it is generally believed that railroad operations will not be interfered with as heretofore.

During the last two weeks several trains of coke and coal reached Chihuahua, thus relieving the fuel shortage at both the reduction works and the mines. More is en route so that no early shortage is anticipated. The Chihuahua smeltery of the American Smelting & Refining Co. has six furnaces in blast and is securing an abundance of ore from the Santa Eulalia and other camps. The Rio Tinto smeltery at Terrazas has operated without interruption. The Torreon reduction works has not been closed down during the recent crisis but has been compelled to curtail somewhat. The Velardeña plant of the American Smelters Securities Co. has not yet resumed operations, nor has the plant at Matehuala. The American Smelting & Refining Co. smeltery at Monterey, however, is again in operation as is presumably the Aguascalientes plant.

Conditions in Parral Are Bad according to the last reports. The camp has been without train or telegraph service since about Feb. 20, and the majority of the mining properties have suspended work. Needless to state, the mining districts tributary to the Parral branch of the National Rys. of Mexico have suffered and are suffering severely but it is believed that relief may shortly be afforded. The operative properties in the western part of the state are in regular commission although considerable difficulty has been experienced in the securing of supplies.

In the Coahuila coal districts, little or nothing has been going on for the last two weeks and judging by the revolutionary activities, but little production can be looked for for some time. With the cutting off of the coal and coke supply from these fields it is necessary to bring in all fuel from the United States via El Paso. This is a hardship on account of congested traffic and additional expense.

Throughout the state of Durango the mining industry has been demoralized for several weeks, partly on account of revolutionary troubles and partly from the disruption of railway traffic. No definite news from the several mining camps has been available since about the middle of February, but it is probable that the larger companies have been able to continue work on a small scale. While immediately the outlook may not be bright, mining men express confidence in the early return of normal conditions.

THE MINING NEWS

ALASKA

GOLD MINING & DREDGING CO.—This company's property has been bonded by Frank Manley, of Iditarod, who will install dredging machinery.

SLUICING HAS BEEN STARTED IN RUBY CAMP, marking the earliest start of a spring cleanup in the history of any sluicing camp in Alaska.

ALASKA-TREADWELL—In January, 71,400 tons of ore was crushed for a yield of $155,184, or $2.19 per ton; the net operating profit being estimated at $67,031.

ALASKA-MEXICAN—In January, 19,908 tons of ore was crushed for a yield of $35,079 in bullion and concentrate, or $1.80 per ton. The estimated operating profit for the month was $8567.

ALASKA UNITED—In January, 17,920 tons of ore was crushed in the Ready Bullion mill for a yield of $46,707, or $2.63 per ton; the estimated net profit being $21,959. In the 700-Ft. Claim mill, 19,393 tons of ore yielded $39,199, or $2.04 per ton; the estimated net profit being $13,656.

ARIZONA

Gila County

A CHALK DEPOSIT is owned and being opened by C. H. Patrick, about 20 miles from Winkelman. Several shipments of chalk have been made to Los Angeles.

Mohave County

GOLDEN EAGLE—Work has recently been started by J. N. Nieset, of Gibsonberg, Ohio.

RAINBOW—A carload of gold-silver-lead ore from this mine is being shipped daily from Chloride.

PINKHAM—It is reported that L. A. Dockery is making excellent progress in sinking the two shafts on this property to the 300-ft. level.

MIDNIGHT—The new mill has been in operation about one month. It has a capacity of 30 tons per day. The mine is being operated by Kean St. Charles.

FROST-MEYER—A tunnel is being driven along the vein of this Wallapai Springs property, and the ore is being sacked and hauled to the Last Chance mill.

NEAR McCONNICO work has been started on a group of claims by Thomas Steinburg. It is reported that a promising streak of ore has been discovered.

HORSESHOE—A new shaft has been started and is now 90 ft. deep, at this mine west of Cerbat. The bottom of the shaft is in good ore. Frank O'Dea is in charge.

VIVIAN—Ore was cut on the 250-ft. level on the Mitchell claim and was found to be of good milling grade. The shaft is now more than 400 ft. deep and is being sunk to the 500-ft. level.

NIGHTHAWK—It is reported that this property has been leased to men from Goldfield, Nev. The old workings are being cleaned out and preparations are being made for sinking the shaft.

HERCULES—It is understood that development work on this property will be resumed by A. W. Brauntland. Considerable work has already been done on the property and some milling ore is in sight.

SAN ANTONIO—It is reported that the tunnel has opened promising ore at this claim at Deluge, Wash. The ore contains some copper and lead, but is mined principally for the gold and silver. W. D. Grannis is in charge.

CYCLOPIC—The control of this property has recently passed from Robbins & Walker, of San Francisco, to S. C. Bagg, who has operated the property on a small scale for several years, but now intends to improve the equipment in order to increase production.

JUPITER—Wilhelm & Harrison, who have been working this property for several months, have opened rich ore that seems to be quite extensive. Several tons have been sorted and are ready for shipment, the gold tenor of which is estimated to be $160 per ton.

DE LA FONTAINE—E. C. Lane, of the Swansea Consolidated Smelting Co., has taken a bond and lease on this and the Cupel mines on Stockton hill. The De la Fontaine was recently worked by lessees who took out and shipped several cars of lead and zinc ore. The Cupel has been idle for years, but at one time produced high-grade ore from a pocket. James O'Brien will have charge of the mining work. The shaft on the De la Fontaine is to be sunk several hundred feet and the Cupel shaft retimbered and repaired.

ARIZONA SOUTHWESTERN COPPER CO.—Recent developments have resulted even better than anticipated by the management. On the 300 level, which connects the two shafts, crosscuts have been driven 100 ft. apart for 800 ft. and have shown what appears to be a continuous shoot of ore at least 800 ft. long and 8 to 18 ft. wide. The ore assays about $24 per ton in gold, silver, lead and copper. Concentration tests have been successful, and a 150-ton mill has been built. The main shaft is to be equipped with an electric hoist. It is reported that in cutting into one of the walls a new oreshoot was discovered on the 300 level.

Maricopa County

YOUNG MINES CO.—In a seven-day test run in the new mill, northeast of Mesa, 124 oz. of gold was recovered from 147 tons of ore from the north shaft.

Pima County

GOLD BULLION—Five tons of high-grade gold-silver ore is being shipped weekly from the Last Chance group.

STERLING—A company recently incorporated in Colton, Calif., has purchased this property and as soon as the camp is established will begin work in the mines.

ISABEL—The lessees, O'Hara & Boykin, are shipping at the rate of 50 tons per week. The Double O Mining Co. has been incorporated to take over the lease on the property.

MADERA MINING CO.—Work has been resumed on the 500-ft. crosscut tunnel under the direction of H. E. Brandt. The property is equipped with air drills and compressor.

NEW STATE MINING CO.—The new crosscut tunnel, which is more than 1000 ft. long, has been completed. It cuts the vein at a depth of 500 ft. The vein is 40 ft. wide and the ore contains lead, copper and silver.

Yavapai County

MONTEZUMA MINES—A contract has been let to extend the Bear tunnel an additional 200 feet.

OCTAVE—It is reported that operations at this property, near Congress Junction, will be started about May 1. The mine is fully equipped, and there is a mill and cyanide plant on the property.

CALIFORNIA

Amador County

THE CALIFORNIA DIAMOND DRILL EXPLORATION CO. will remove its principal place of business from Sutter Creek to San Francisco. M. A. Shairp is president.

FREMONT—The new steel headframe has been put in commission. It is 103 ft. high and similar in construction to the steel headframe recently installed at the Bunker Hill. The shaft has been deepened to 2200 ft. and a station cut at the 2150-ft. level. Good ore is reported at the lowest level. W. L. Palmer, of Drytown, is superintendent.

THE KENNEDY EXTENSION VS. ARGONAUT APEX SUIT has, by stipulation without prejudice, been set for hearing by the superior court without jury, May 2. The complaint was filed Dec. 1, 1909. The plaintiff asks for $200,000 damages for ore mined from the vein said to extend into the Muldoon mine. The delays in the trial of the suit have retarded improvement and development of the Argonaut.

Butte County

UNITED STATES DIAMOND MINING CO.—It is reported that more than 90% of the stock has been pooled and that negotiations are in progress for reopening the property at Cherokee.

CRYSTAL—Fire destroyed the hoist and boiler house Mar. 1. The miners were in the mine at the time, but were able to reach the surface by the manway in the shaft. The loss is about $2000. The mine was formerly known as the Princess and is near Magalia. R. C. Andruss is superintendent.

ST. FRANCIS—A strike of ore is reported at this mine in the Forbestown district about five miles northwest of Forbestown. A crusher and new Bryan mill were recently installed. John P. Horgan and James Hurley, of San Francisco, are owners. Patrick Riordan, of Forbestown, is superintendent.

KENTUCKY RANCH MINING CO.—Suit has been filed against this company by the Security Investment Co. for damages alleged to have been done by the deposition of dredge tailing in a creek from which plaintiffs obtained water for irrigation. The sum asked is $25,000. The dredge is now out of commission.

Calaveras County

DUCK BAR MINING & MILLING CO.—The property has been sold at trustees' sale in satisfaction of judgment to M. H. Manuel.

HODSON—The new 6-stamp mill is in commission; fifteen tons of concentrates was recently shipped. The mine is near Angels and is worked under bond by Brown & Donner.

RISING STAR—Blue gravel closely cemented and carrying gold in good quantity is reported at a depth of 160 ft. from the surface. The property, situated three miles west of San Andreas, is owned by David Cassinelli, and is reported to be bonded to J. E. Richards, of Boston. The price is said to be $20,000.

REINER—The rebuilding of the hoist, pumping plant and blacksmith shop destroyed by fire last December, and the retimbering of the shaft are about completed. It is reported that just prior to the fire rich gravel was discovered by miners in the shaft, but the fact was not made known until recently. John C. Benson, of Alta, is superintendent.

Eldorado County

MARGUERITE—A strong vein has been encountered at 125 ft. depth. The pay ore assays between $3.50 and $8.50 per ton. There is a streak of high grade. The mine is three miles south of Placerville. Frank Everett is superintendent.

Kern County

INDIAN WELLS DISTRICT is reported to be proving well. A large tonnage of ore has been extracted. Good ore is reported also in a 12-in. vein at Cowhaven, five miles northeast.

PLACER GOLD CO.—A trial run of 500 cu.yd. of gravel was recently made. Continuous runs of the new plant will

begin as soon as the electric power is ready. E. Coppock, of Los Angeles, is secretary.

YELLOW ASTER—The dividends paid in January and February, bring the total dividends since incorporation to $1,141,789. The recent storm interfered only with work in the glory hole for a few hours of one day.

G. B.—It is reported that ore 30 ft. wide has been disclosed on the 225-ft. level. A crushing and cyanide plant will be installed. The mine is situated one mile south of Randsburg on a vein striking north and south through the Stringer district.

Inyo County

FOUR METALS—The suit to oust L. D. Gordon from possession has been dismissed by agreement between directors and stockholders. The property is to be transferred to William A. Beasly and L. L. Dennett as trustees for the stockholders and directors. The Cerro Gordo, the principal mine in the holding, will now continue in operation without further interruption. It is an old producer of gold and silver, and is at present producing zinc and lead ores discovered by Gordon, who has recently shipped 14,000 tons.

COLORADO

Clear Creek County

COMBINATION MILLING & LEASING CO.—This company's mill at Idaho Springs is again in operation. Richard Staley is manager.

KITTIE OUSLEY—The shaft will be unwatered and the vein of silver-lead ore exposed in the bottom will be developed by drifting.

HOOSAC—On acount of the hardness of the ore it has been found necessary to install heavier crushers in the mill for preliminary breaking. The first car of concentrates has been shipped.

ACCORD—This company controls the Cully Tunnel property on Saxton Mountain. Drifting will be started on the veins cut 800 ft. from the portal and the main crosscut will be advanced. Lessees have opened a 7-in. vein of silver ore.

Lake County-Leadville

RESURRECTION—Lessees are shipping about three carloads weekly of zinc-carbonate ore, which is several feet thick.

LITTLE ELLA—Lessees are sacking rich gold ore. The ore from the main shoot is being shipped regularly to the Arkansas Valley smeltery.

LA PLATA—From the 360-ft. level lessees continue to ship the usual tonnage of zinc-carbonate ore and to date have received no orders to curtail shipments.

IRON-SILVER—Heavy shipments are being made from the Moyer, Tucson and other mines in this group at Leadville. The company paid $250,000 in dividends in 1912, and is said to be considering investing in other properties in Colorado. George O. Argall is in charge.

LUCERNE—Lessees recently cut several stringers of lead-carbonate ore in the bottom level, and are now prospecting from the orebody from which the stringers are offshoots. In one of the upper levels a small body of iron has been opened, but so far the grade has not been high enough to permit shipping.

San Juan Region

LEWIS—A small force of men is employed on development work.

CARBONERO—The lower crosscut tunnel is being advanced 250 ft. by contract.

PRIMOS CHEMICAL CO.—It is reported that the capacity of this company's mill at Newmire will be doubled and that within a few months it will be treating 120 tons per day.

MORNING STAR—The main crosscut which is being driven to develop this property from a point near the head of Bilk Creek, is now about 100 ft. long. W. R. Vanderveer is manager.

ORO CASHIER MINING, MILLING & POWER CO.—This company has been organized to develop a group of mining properties near Ophir Loop. The property includes six lode and one placer claims in the Iron Springs mining district on the south slope of Silver Mountain, about 1½ miles from the railroad at Ophir Loop. Preliminary sampling has been satisfactory and development has begun. The capitalization is $200,000, in 100,000 shares. There are 55,000 shares outstanding. E. H. Van Endert is president and general manager.

Summit County

BULLION KING—R. W. Foote is leasing this property near Breckenridge and has opened a 3-ft. vein of argentiferous zinc blende. The ore was found 12 ft. above the tunnel level. The tunnel will be driven another 35 ft., when another raise will be started.

Teller County-Cripple Creek

ELKTON—It is reported that a rich ore strike has been made either in Elkton ground or most recently acquired territory.

PORTLAND—Lessees did well in February, shipping 625 tons of ore to the Portland mill at Colorado City, which they claimed ranged in value from $20 to $25 per ton. T. J. Dalzell, formerly commissioner of mines, was the heaviest of the 14 shippers.

VINDICATOR—The mine is said to be in better condition now than at any previous time. A recent strike on the 1600-ft. level, has been yielding ore, so far as developed, that assays $30 per ton. The extent of the ore has not been determined.

EL PASO—The February output was about 100 cars of $20 ore, of which about 60 cars was shipped by the company and the rest by lessees. A good deal of development work was completed last month and the starting up of the Nichols shaft necessarily prevented some shipments which would ordinarily have gone out.

LOUISIANA

Assumption Parish

DRILLING FOR OIL has been begun on the Laurel Ridge plantation, nead Labadieville. Both oil and sulphur are believed to exist in this region.

Caddo Parish

SHREVEPORT NATURAL GAS CO.—A well has been drilled at a depth of less than 1000 ft., the flow of gas being heavy.

St. Landry Parish

DUSON MINERAL OIL CO.—In drilling a well in the Pine Prairie field, the pipes broke at a depth of 3000 ft., necessitating the removal of the drilling outfit in order to repair the break. x

MICHIGAN

Copper

A STRIKE OF 250 TRAMMERS at the Mohawk mine is reported in a press dispatch.

AHMEEK—Plans are being made for enlarging the stamp mill and it is probable that ground will be broken during the summer.

INDIANA—The shaft is about 1360 ft. deep and should reach the felsite formation any time now, as it was estimated that it would be reached at a depth between 1350 and 1400 ft.

FRANKLIN—No. 1 shaft is down to the 36th level and a material improvement is being noted in the grade of the ore, particularly from the 26th to 33d level where high-grade ore has been opened. Shipments to the mill average about 750 tons daily.

HANCOCK—The Pewabic lode was reached at a depth of 3650 ft. in the lateral opening about 100 ft. from the shaft. The face is heavily charged with copper. This property will be in a position to maintain regular shipments to the Lake Milling, Smelting & Refining Co. mill where one head has been contracted for, about June 1. The work of cutting out the loading stations at the main shaft is going forward satisfactorily.

ADVENTURE—Operations have been discontinued and the entire operating force has been laid off. Results have been discouraging. During the last year a large amount of exploratory work was carried on from No. 5 shaft to prove the three copper-bearing formations that showed encouragingly in the drill cores. The three lodes were cut in crosscutting from a depth of 1500 ft. in the shaft and drifting was done at the point of intersection and while the formations were comparatively wide they did not show much promise as copper producers. Operations sometime previous to the shutdown were confined to diamond drilling from the bottom of the shaft to test the formation below.

Iron

CLEVELAND-CLIFFS IRON CO.—One drill hole has been sunk on Sec. 12 in the Mastodon district, and it is understood that iron formation was cut.

ON THE MARQUETTE RANGE there has been considerable winter shipping by all-rail routes. The American mine has been shipping to the Canadian Soo; the Cleveland-Cliffs Iron Co., the Breitung-Hematite mine and the Republic Iron & Steel Co. have shipped to the charcoal-iron furnaces of the Lake Superior Iron & Chemical Co. at Newberry, Mich.

CASCADE MINING CO.—This new company on the Cascade range has secured a railroad extension from the Palmer branch of the Chicago & Northwestern Ry. in to its Isabella mine, surveys for which were made last year. The big Isabella shaft is 170 ft. deep and the sinking is now entirely in a coarse diorite dike similar to the material in the Lucky Star shaft at Negaunee.

CORRIGAN-MCKINNEY & CO.—This company plans to erect new, modern surface equipment at its Tully mine in the Iron River district, and is receiving bids for the various buildings. These will include a change-house, a warehouse, and a combination blacksmith and carpenter shop, similar to the combination shop at the Rogers mine. Excavation has been begun for a new boilerhouse and four more boilers will be added, making seven in all. Forty new company dwelling-houses are nearly finished, and all the dwelling-houses from the Baker mine have been moved to the Tully. In Tully No. 1 shaft drifting for ore has been begun; No. 2 shaft is 115 ft. deep.

MINNESOTA

Mesabi Range

EATON—This property, at Buhl, will begin producing this season, and will be operated by the Robertson-Hoar Iron Mining Co. A shaft is now being sunk, and the ore ranges from 20 to 30 ft. in thickness.

INTERSTATE MINING CO.—The Columbia mine, at Virginia, will be stripped and worked by this company. It will be an open-pit mine and within three blocks of the business district of the town. About 200 houses will be removed from the property, and it will take several years to remove all the mineral. Stripping of the ore will commence as soon as all buildings have been removed from the ground.

OLIVER IRON MINING CO.—Open-pit operations at this company's mines will begin about Apr. 15. Preparations for work have already been begun. Shipping will probably begin about two week before the opening of navigation. The company has been operating 19 underground mines on the Mesabi range and five on the Vermilion, at which stock piles have been built up during the winter months. About 350,000 to 400,000 tons of ore have been produced monthly on the Mesabi range and about 90,000 to 100,000 tons per month on the Vermilion. The mines that have been producing all winter are as follows: On the Mesabi range, the Burt, Dale, Harrold, Mace, Mississippi, Uno, Winnifred, Clark, Chisholm, Leonard, Munroe-Tener, Meyers, Adams, Spruce, Fayal, Genoa, and Sauntry-Alpena. On the Vermilion range, the Pioneer, Savoy, Sibley, Zenith and Soudan, have been operated. An average of about 7600 men has been employed during the winter.

MONTANA

Butte District

PILOT-BUTTE—At the annual meeting of stockholders, held at Butte Mar. 10, the following directors and officers were elected: Edward Hickey, of Butte, president; L. I. Crossley, of St. Paul, first vice-president; and J. W. Pratt, of Butte, second vice-president; J. J. Harrington, secretary; Charles R. Leonard, Patrick Sheehan, John J. McHatton, of Butte; N. J. Bielenberg, of Deer Lodge; T. E. Murray, of St. Paul, and William P. Jahn, of Milwaukee, directors. In 1912 the shaft was sunk, three compartments wide, a distance of 676 ft. to a depth of 1607 ft. A station was cut on the 900-ft. level, and 255 ft. of drifting and 650 ft. of crosscutting was done on this level. On the 1300-ft. level a station was cut and the crosscut from the Black Rock shaft was driven 143 ft. to a connection with the Pilot-Butte workings. A Nordberg hoist, capable of hoisting from a depth of 2500 ft., was installed. The shaft has now reached a depth of slightly more than 1800 ft., and will be continued to the 2000-ft. level, after which stations will be cut on the 1600-, 1800- and 2000-ft. levels, and development started.

TUOLUMNE—The annual meeting of stockholders was held at Butte Mar. 10, and the following officers were elected: Edward Hickey, president; R. J. McDonald, first vice-president; and J. W. Pratt, second vice-president; Edward Hickey, R. J. McDonald, J. W. Pratt, Charles R. Leonard and Daniel Shields, of Butte; N. J. Bielenberg, of Deer Lodge, and T. E. Murray, of St. Paul, directors. During 1912 the mine produced 46,683 tons of ore containing 4,716,047 lb. of copper; 131,867 oz. of silver and 259 oz. of gold. The first-class ore mined averaged 7.35% copper, and 3.38 oz. silver. The second-class ore averaged 4.05% copper, and 2.58 oz. silver. The gross value of the metal mined amounted to $739,196, and the net after deducting freight and smeltery charges, $415,528. The shaft was sunk three compartments wide, a distance of 205 ft. to a depth of 80 ft. below the 2000-ft. level. Drifting was done to the extent of 1464 ft.; crosscutting, 529 ft.; raises, 1330 ft., and winzes, 30 ft. A station was cut on the 2000-ft. level and the 1600-ft. station enlarged. Production during the year came from the 1200-, 1600- and 1800-ft. levels. Shaft sinking has been continued steadily, and the shaft is now 40 ft. below the 2200-ft. level. A station will soon be cut on this level and development work started.

Deer Lodge County

BIG BILL—A wide vein of good ore was recently encountered at this property in the Georgetown district.

Lewis & Clark County

PEACH—William McCabe, of Butte, who took a lease and bond some time ago on the Peach, Pear and Plum group of quartz claims in the Little Creek district, began mining operations about Jan. 1, and has since shipped three carloads of high-grade gold, silver and copper ore to the Pittsmont smeltery at Butte. The Hudson brothers, of Helena, worked the property in a small way for several years, sinking a shallow shaft and running two tunnels, resulting in the opening of some ore.

NEVADA

Comstock Lode

SIERRA NEVADA—The vein on the 2000-ft. level, has gradually widened, with development work to the northeast, and it is from 8 to 10 ft. wide. The quartz is low grade. The country is to be crosscut both east and west.

CONSOLIDATED VIRGINIA—The northwest crosscut from the 1000-ft. station of the shaft, has entered another block of heavy ground which is retarding progress somewhat, only 15 ft. per week being gained. This drift has fully 200 ft. to advance before cutting the East vein on this level.

OPHIR—The understope below the sill floor of the southwest drift on the 2400-ft. level is showing greater width of milling-grade ore at depth, and a considerable tonnage is being secured to the north, 30 ft. below the head of the winze. Ore shipments are being made to the Kinkead mill, and a cleanup of bullion and concentrate was recently made.

ALTA—A statement just issued by the president of the company is to the effect that pumps will not be placed in the property until some of the adjoining companies have succeeded in lowering the water. This policy is adopted as a safeguard to prevent possible flooding, in case Alta should proceed first. As soon as the Crown Point pumps are successfully working, activity along this line is looked for at the Alta.

MEXICAN—The tramway from the mill to the Monte Cristo mine in Sevenmile cañon, operated by this company, has been completed, and worked successfully upon its first test run. It will be placed in regular service soon, a large tonnage of low-grade ore having been blocked out in the mine. In the Mexican mine, some ore is being extracted from the north stope on the 2500-ft. level, but the other levels have been cleared of ore, working material and equipment.

Clark County

ALICE COPPER & ZINC MINING CO.—This company was recently incorporated to take over the Alice group of 12 claims, adjoining the Yellow Pine on the south. A. J. Robbins is president, E. B. Critchlow, vice-president, and A. E. Thomas, secretary. The force of men now at work will be increased, and considerable development work undertaken. The property has been a steady shipper during the last winter.

BULLION—The material for the new aërial tramway is on the ground, and the towers have already been erected. Ore bins are now being built at the foot of the tramway. The new gasoline hoist has also arrived and will be erected now. A new headframe will also be built. All men have been taken from underground during the erection of the new equipment, but shipments are expected to be resumed by Apr. 1. O. J. Fisk is in charge of the work.

HONDURAS—Excitement has been caused by the discovery of rich silver ore on this claim, which is one of the old Keystone group. The claim is now under lease to Buys & Kunz, who recently opened a 4-ft. vein of lead-carbonate ore impregnated with silver chloride. The ore occurs along a fault in limestone near a porphyry contact. The lessees have already sacked about 30 tons that sample 50% lead and 500 oz. silver per ton, while some sacks assayed as high as 2000 oz. per ton.

Humboldt County

A ROAD BETWEEN ROCHESTER AND OREANA is now being graded.

Nye County

BIG FOUR—The new mill at Manhattan has been put in commission.

SHIPMENTS in tons from Tonopah mines for the week ended Mar. 8.

Tonopah Mining	2,750	North Star	....
Tonopah Belmont	3,647	Mizpah Extension	....
Montana-Tonopah	1,115	Jim Butler	450
Tonopah Extension	1,085	Tonopah Merger	225
West End	1,000		
Midway	100	Total	10,946
MacNamara	574	Estimated value	$232,644

BULLFROG MINING SYNDICATE—This property comprises four claims at Pioneer. Prospecting on a contact of lime and quartzite, which traverses the property, disclosed some ore at or near the surface. Most of the gold is in the material between the quartzite and the lime. A shallow tunnel was driven for 50 ft. on this contact, determining its course, and a shaft was started carrying the quartzite for the foot wall. This shaft has attained a depth of 175 ft., and drifts have been driven both ways on the contact; the north drift is about 100 ft. in length, and the south drift, about 50 ft. Ore has been found at various places, but as yet, none as rich as was found nearer the surface, but neither drift has been driven far enough to encounter the continuation of the ore which is found above. Some ore from the south drift shows gold in panning in identically the same formation as the surface ore.

NEW MEXICO

Grant County

CLEVELAND GROUP—This zinc-producing property in the Pinos Altos district, owned by George H. Utter, who shipped 3,100,000 lb. of concentrate in 1912, is reported under option to the Guggenheims.

Sierra County-Hillsboro District

MAMIE RICHMOND—This gold mine near Hillsboro, financed by women, is now idle

HILLSCHER PLACERS—A dry-washing plant is being operated on these placers near Hillsboro. Hilscher Bros. are the operators.

VANADIUM QUEEN MINING CO.—This vanadinite property recently made a trial shipment of high-grade ore. The mines have not been operated this year.

GOOD HOPE, AND BONANZA—These properties are on the west of the Statehood, and are owned by Miller Bros., of Osage City, Kan. Leasing is being done.

READY PAY—This gold mine adjoining the Statehood on the east is idle pending a readjustment of finances. The Villard estate of New York is largely interested. A small mill is on the property.

WICKS—An examination of the ore reserves of this Hillsboro property has recently been made. The mine is being developed by a company controlled by J. J. Summers & Co., of Chicago. The shaft is down 500 ft. Plans for a mill are being considered. A. G. Veig is manager.

STATEHOOD—This company, successor to the Sierra Consolidated Gold Mining Co., of which Warner Miller was president, has been in the hands of a receiver since last June. The company owns the Snake and Opportunity mines northeast of Hillsboro. A 30-stamp mill is on the property and both mines are extensively developed. Recently an examination of the property, with a view of financing it, was made. W. F. Hall is receiver.

OREGON

Baker County

MORNING—The mill is in operation; Frank Pierce is manager.

RED BOY—The mill is running after several years of idleness; John Farrell, manager.

Coos County

OCEAN BEACH MINING CO.—This company, controlled by Minneapolis men, has completed its camp near Randolph, north of Whisky Run and 12 miles from Bandon. A Nomebeach type of dredge is now being hauled to Whisky Run. This machine was built at Marion, Ohio, and was designed by R. Smith Bassett.

Josephine County

OLD CHANNEL MINING CO.—Dr. J. F. Reddy has been appointed receiver for this old mine.

BARR—This property is being operated under lease this season by Moore Bros. Two No. 2 giants are being operated day and night.

OSCAR CREEK—This placer mine is being operated night and day and the season has been a good one, promising to be the longest for several years. Several shipments of gold have been made.

LITTLE WINDY PLACER—A rich channel has been opened, which is reported to be over 200 ft. in width and 20 ft. deep. The property is equipped with a giant and is being operated steadily.

Malheur County

GOLDEN EAGLE—This mine, six miles west of Malheur junction, has resumed operations under the management of F. H. Johnson.

RAINBOW—The capacity of the mill on this property is to be doubled; a 5-stamp battery is in operation. The mine is seven miles from Malheur Junction.

UTAH

Beaver County

MAJESTIC—The Old Hickory, owned by this company, is developing copper ore.

LEONORA—A recent strike is reported of lead-silver-zinc ore of good grade.

ROB ROY—A car of ore, now stockpiled, will be shipped soon. It is understood that work will be resumed in the spring.

SUCCESS—This property, in the Beaver Lake district, 12 miles from Milford, will soon ship its first car of ore. Two more will follow as soon as hauling facilities are available.

MOSCOW—More development work than usual is being done, and it is probable that the March dividend of 1c. per share will be postponed and a dividend of 3c. per share be declared in June. Shipments for January and February totaled 34 cars or 1700 tons.

Juab County

TINTIC SHIPMENTS for the week ended Mar. 7 were 215 cars.

CHIEF CONSOLIDATED—In the week ended Mar. 7, 14 cars of ore were shipped. Water level was reached in the shaft at 1815 ft., and a station will be cut a little above the 1800, where drilling will be started to get under ore opened on the upper levels.

LEHI TINTIC—Preparations are being made to market 25 tons of sorted ore from the big vein on the tunnel level. The ore contains lead, silver and a little gold. The property is about two miles from the railroad at Homansville, but the ore will be hauled to Topliff, a distance of six miles, at a cost of $2 per ton, and shipped from there.

Salt Lake County

UTAH COPPER—The quarterly dividend of 75c. per share has been declared, payable Apr. 1, to stockholders of record, Mar. 7.

BINGHAM MINES—The annual report shows a balance of cash and collateral loans of $165,976, and $17,500 notes receivable at the close of 1912. In 1912, the company earned $138,113 as compared with $109,248 in 1911. Bonds amounting to $81,000 were retired, leaving $455,000 still outstanding. At the Dalton & Lark, 1953 ft. of drifts, crosscuts, raises and winzes were driven, and some oreshoots were opened, and partially developed. A large tonnage was mined from the main oreshoots, and a reserve left for the coming year. The Brooklyn and Lead mine were liberal producers, while the Lark vein yielded a small tonnage of ore of higher grade. Extensive development will be continued along the unprospected parts of the three well known veins. The Commercial mine was operated only 7½ months, on account of bad air and the Bingham strike. Mining was confined to ore developed above the 330 level. No new ore was developed west of the shaft, and the reserves above the 150 level west have been exhausted. Ore was opened on the 360 and 500 levels east, yielding a good tonnage, although low grade. Development is to be undertaken below the 330 level. During the year, 986 ft. of drifting, etc., was done. The shaft intended to connect the Yosemite mine with the Mascotte tunnel should be completed this year by April or May. It will be 2200 ft. long, and a raise of 1100 ft. is being made to connect from the tunnel level; additional territory for prospecting will be opened.

WISCONSIN

Platteville District

VINEGAR HILL ZINC CO.—This company has completed shaft sinking and is preparing to erect a 100-ton mill on the Frederick Masbruch land east of Elmo.

PRESTON POINT—The Wilson Mining Co. has been incorporated to operate this mine near Potosi; the property is fully equipped with mill and mining machinery.

MINERAL POINT ZINC CO.—This company has purchased the Franklin holdings at Highland, which, together with the Kennedy and other tracts recently taken over, give it complete control of practically the entire output of carbonate ore mined in this district.

CANADA

British Columbia

SHIPMENTS FROM LEADVILLE may be made this summer as a result of a government appropriation for road building.

YANKEE GIRL—Three machine drills are running in this mine near Ymir. Stoping is under way in the tunnel level 1700 ft. from the portal.

LAURIER MINING CO.—Operations have been resumed at the property of this company at Laurier. A tunnel is being driven to cut the vein of copper ore.

INDIANA MINING CO.—A contract for the further driving of the tunnel on the property of this company in the Leadville district has been awarded to Earnest Rice.

Ontario-Cobalt

SILVER CLIFF—Development has again been started and the mill should be running by Apr. 1.

CONIAGAS—The production for the first quarter of the fiscal year was 900,000 oz., which is about the same as the previous year.

LA ROSE—The usual quarterly dividend of 2½% has been declared and in addition, a bonus of 2½%. Dividends are payable Apr. 20.

CASEY COBALT—A new oreshoot has been discovered in the old workings at the 160-ft. level. The new mill is treating 25 tons of low-grade ore daily.

NIPISSING—The regular quarterly dividend of 5% and a bonus of 2½%, payable Apr. 20, has been declared. The low-grade mill is treating 200 tons per day.

CITY OF COBALT—An injunction has been filed against the directors by R. S. Sproule, restraining them from selling the property to English buyers as sanctioned at a recent shareholders' meeting.

SHIPMENTS of ore and concentrates, in tons, from Cobalt mines for February were as follows:

Bailey	.....	Kerr Lake	30.64
Beaver	52.06	La Rose	246.83
Buffalo	.....	Lost and Found	.....
Casey Cobalt	30.25	McKinley-Darragh	265.48
Chambers-Ferland	32.00	Nipissing	82.67
City of Cobalt	.....	Nipissing Reduction	85.80
Cobalt Lake	104.03	O'Brien	31.08
Cobalt Townsite	147.50	Penn.-Canadian	.....
Colonial	21.36	Provincial	.....
Coniagas	152.45	Right of Way	.....
Crown Reserve	26.02	Seneca Superior	73.62
Dominion Reduction Co.	.....	Silver Queen	60.84
Drummond	65.23	Timiskaming	75.14
General Mines	8.80	Trethewey	62.54
Green Meehan	.....	Wettlaufer	60.56
Hargraves	.....		
Hudson Bay	63.30	Total	1778.20

Ontario-Porcupine

LUCKY CROSS—A new vein, carrying good ore has been cut on the 200-ft. level of this Swastika property.

HUGHES—This property in the Swastika district has been purchased by the Great Northern Silver Mines, Ltd., a Cobalt company.

CARTWRIGHT GOLD FIELDS—This company, operating in the Pain Killer Lake district, is making a public issue of stock. While some rich ore has been found, the vein is narrow and the ore is spotty.

APEX—F. L. Mapes is suing this company for $25,000 worth of shares which he claims is due him for promoting the company. In default of this action he makes authentic claims for the same amount against Robert Bruce, A. M. Bilsky and J. Friedman.

SWASTIKA—The annual report for 1912 shows total receipts of $75,513, of which $55,426 came from the sale of treasury stock, and an expenditure of $73,995. The mine has been opened to a depth of 400 ft., but the second, third and fourth levels are disappointing. The new mill has been started.

Quebec

ASBESTOS CORPORATION OF CANADA—The first report of this company, which last June took over the properties of the Amalgamated Asbestos Co., covers seven months ended Dec. 31, and shows net profits of $150,304. Interest on the bonds amounted to $82,222, leaving $68,082 to be carried forward. The company is at present working three plants, the Kings and Beaver properties at Thetford Mines, and the British Canadian at Black Lake. The management is considering the installation of new machinery to reduce the cost of production.

MEXICO

Durango

SAN VICENTE—This company, operating a 22-stamp mill, is installing equipment for treatment of slime. Formerly part of the slime was treated in grinding pans and decanted, using 10 lb. of cyanide per ton, by which a recovery of 70% was effected. The new equipment will include 10 Butters filter leaves, Byron Jackson pumps, mechanical agitators and Parral air jets. The property is 100 miles from a good wagon road. The company has been forced to donate to revolutionists and the camp is in a continuous state of unrest. George B. Dillingham is mill superintendent.

Sonora

EL COBRE—At this mine, near Hermosillo, development work only is being done. B. A. Ogden, manager.

LAS ANIMAS—A leaching plant is being erected at this mine in the San Xavier district, W. C. Laughlin, lessee.

TOLEDO—This property has been sold at sheriff's sale to men from Toledo, Ohio, who will now decide upon the advisability of operating a smeltery.

CANANEA CONSOLIDATED—The third new converter of the Great Falls type has been installed, and the fourth is being set up. Two more converters of the same type are to be installed.

MINA MEXICO—The smeltery has been shut down for several months, but a supply of coke is now being received and the manager, W. E. Pomeroy, expected to blow in the furnaces early in March.

SAN NICHOLAS—It is reported that this mine east of La Dura, which was bonded several months ago to James S. Douglas, has not proved to be a producer of commercial ore. The option will be allowed to lapse.

CERRO DE PLATA—A shipment of 30,000 oz. of silver bullion was recently made from this mine to the Selby smeltery at San Francisco. The old company, the Cerro de Plata Mining Co., is to be reorganized soon, a meeting for this purpose will be held in Nogales.

MONTE CRISTO—This property at Moctezuma, owned by C. C. Soto, is again being operated after a period of idleness. Work was recently begun on the 300-ft. level and the vein has been cut, the ore being rich in silver. Regular shipments are now being made to the Copper Queen smeltery at Douglas, Arizona.

Zacatecas

VETA GRANDE—A. Goerz & Co., Ltd., of London, correct the statement made in the Journal of Feb. 8, p. 350, stating that the company is not interested, but that John M. Nicol has an option on the property.

GERMANY

A FIRE AT THE PRESIDENT COLLIERY, near Bochum, broke out Mar. 18. The superintendent was killed; he was underground with an unknown number of miners.

ASIA

Chosen

ORIENTAL CONSOLIDATED MINING CO.—The cleanup for February was $127,400.

THE MARKET REPORT

METAL MARKETS

NEW YORK—Mar. 19

The metal markets show no special change for the week. Copper has been quieter than last week, and tin is still depressed, though a turn in the market may be expected at any time.

Exports of specie from New York, week ended Mar. 25 were: Gold, $7,833,455, chiefly to London, Paris and Buenos Aires; silver, $1,145,687, chiefly to London. Imports were: Gold, $631,601; silver, $137,577, from Mexico and Central America.

Gold, Silver and Platinum

Gold—The price on the open market in London remained at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was some pressure for gold for Germany, but not enough to secure a premium over the Bank rates. In New York exports continue, $6,000,000 having been taken for shipment to Paris.

Iridium—Supplies are still short, and it is difficult to fill orders. The price ranges about $85 per oz. for what metal can be had.

Platinum—The market is steady and unchanged. Prices appear to be pegged, and no change is expected. Dealers here ask $45@46 per oz. for refined platinum and $49@53 per oz. for hard metal. The foreign market is unchanged.

Silver—The market is quiet at the lowest point touched in the recent fall. The decline is about 7 points below the figures prevailing in early January. This fall is owing largely to disappointment connected with the disruption of the Chinese six-power loan plans. The future is uncertain.

Exports of Silver from London to the East Jan. 1 to Feb. 27, reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India	£1,291,300	£1,247,900	D. £ 43,400
China	400,000	95,000	D. 305,000
Total	£1,691,300	£1,342,900	D. £348,400

Shipments of gold to India were £243,500 for the week.

The net import of gold into India for the month of February, 1913, was £2,049,133 approximately. This is about 40% only of the net import for February of last year.

Copper, Tin, Lead and Zinc

Copper—The market has been extremely dull throughout the week. Some of the agencies have maintained their prices previously asked, but others have made concessions. At all times it has been possible to secure copper at 14⅞c., delivered, usual terms, and during the latter part of the week that price has been shaded. At the close we quote 14⅞@15c. for Lake copper, and 14.70@14.75c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 14.55@14.60c. as an average for the week.

The standard market, after receding gradually from day to day, broke sharply at the close, which is cabled as being weak at £64 2s. 6d. for spot, and £64 7s. 6d. for three months.

Base price of copper sheets is 21@22c. per lb. Full extras are charged, and higher prices for small quantities. Copper wire is 16@16½c. carload lots at mill.

Copper exports from New York for the week were 5851 long tons. Our special correspondent gives the exports from Baltimore at 1015 tons for the week.

Visible stocks of copper in Europe on Mar. 15, were: Great Britain, 23,010; France, 3860; Rotterdam, 4950; Hamburg, 4550; total, 36,370 long tons, or 81,468,800 lb.; a decrease of 180 tons from Feb. 28. In addition copper is reported afloat from Chile, 2770; from Australia, 4500; making a total of 43,640 long tons, or 97,753,600 lb.; a decrease of 1040 tons from the Feb. 28 report.

Tin—The bear operations on the London Metal Exchange continued on a large scale during the latter part of last week. Quotations suffered in consequence, but did not bring any orders from this side. The New York market, in fact, proved to be the cheapest seller of tin, the business taking place here being done at from ¼ to ⅝ of a cent under the foreign levels. The selling pressure in the London market ceased with this week and prices therefore recovered somewhat. The close is steady at £210 for spot, and £206 10s. for three months, and at about 46⅛c. for March tin in this market.

Tin Output of the Federated Malay States, two months ended Feb. 28 was 6255 long tons in 1912, and 5443 in 1913; decrease, 812 tons. Tin exports from the Straits for the two months were 9253 tons in 1912, and 10,615 in 1913; increase, 1462 tons.

Messrs. Robertson & Bense report the arrivals of tin ore and concentrates at Hamburg, Germany, in February at 2025 tons, all from Bolivia.

Receipts of Bolivian tin in Great Britain in February as reported by Messrs. H. A. Watson & Co., included 16 tons of bars and 1929 tons of concentrates containing 1157 tons of tin; a total of 1173 tons tin.

Lead—The market is quiet and unchanged at 4.15@4.20c. St. Louis and 4.30@4.35c. New York.

There has been a very good demand for lead in Europe,

DAILY PRICES OF METALS

NEW YORK

Mar.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St Louis, Cts. per lb.
13	4.8690	57⅞	14⅞ @15	14.70 @14.80	45¾	4.30 @4.35	4.15 @4.20	6.15 @6.20	6.00 @6.05
14	4.8675	56⅞	14⅞ @15	14.70 @14.80	45⅞	4.30 @4.35	4.15 @4.20	6.10 @6.15	5.95 @6.00
15	4.8700	57½	14⅞ @15	14.70 @14.80	45⅞	4.30 @4.35	4.15 @4.20	6.05 @6.15	5.90 @6.00
17	4.8705	57⅛	14⅞ @15	14.70 @14.75	45¾	4.30 @4.35	4.15 @4.20	6.05 @6.15	5.90 @6.00
18	4.8705	56⅞	14⅞ @15	14.70 @14.75	46¼	4.30 @4.35	4.15 @4.20	6.05 @6.10	5.90 @5.95
19	4.8710	56⅞	14⅞ @15	14.70 @14.75	46¼	4.30 @4.35	4.15 @4.20	6.00 @6.10	5.85 @5.95

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. belo w that of electrolytic. The quotations for lead represent wholesale transactionsin the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Silver quotations are in cents per troy ounce of fine silver.

LONDON

Mar.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
13	26⅜	64¾	65¾	70	208¾	205¾	15 11/16	24½
14	26 3/16	64⅛	65¼	70¼	209	206	15⅞	24½
15	26½	....	....	....	....	....	....	....
17	26 1/16	64⅞	65⅛	70	208¾	205¾	15⅞	24½
18	26 3/16	64⅜	64⅞	70	210	206¼	15 11/16	24½
19	26 3/16	64⅛	64⅜	69¾	210	206½	15⅞	24½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence pertroy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, pot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¾c.

particularly for electrical purposes. In consequence the market has moved up somewhat, the close being firm at £16 17s. 6d. for Spanish lead and 7s. 6d. higher for English.

Spelter—Some large tonnages have been negotiated in a rather reluctant market, leading to a sharp decline in the price. Although it is reported that consumption still continues at practically the high-water mark, producers appear to be becoming restive and have been trying to force their current output for sale, in consequence of which the premiums that have been realized for near-by shipment over futures have entirely disappeared. The market closes weak at 5.85@5.95c. St. Louis, and 6@6.10c. New York.

The London market is unchanged at £24 10s. for good ordinaries, and £24 17s. 6d. for specials.

Base price of zinc sheets is $8.25 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

	Nov.	Dec.	Jan.	Feb.
Alaska shipments	1,671,367	3,766,029	1,668,328	660,250
Anaconda	24,250,000	23,400,000	21,000,000	21,250,000
Arizona, Ltd	3,000,000	3,100,000	3,100,000	3,000,000
Copper Queen	8,807,940	8,805,568	7,554,966	6,810,706
Calumet & Arizona	4,918,000	5,840,000	4,750,000	4,050,000
Chino	3,911,169	3,368,850	2,903,030	3,813,998
Detroit	1,968,620	2,389,875	1,769,071	1,689,277
East Butte	1,245,504	1,314,021	1,469,000	.....
Mammoth	1,805,869	1,850,000	.....	.....
Giroux	*nil*	625,000	.....	.....
Mason Valley	1,500,000	1,550,000	1,575,100	.....
Nevada Con.	4,160,533	3,975,631	4,169,705	.....
Ohio	573,644	566,816	.....	.....
Old Dominion	2,758,000	2,727,000	2,727,000	2,381,000
Ray	3,191,026	3,638,500	3,610,000	3,610,000
Shannon	1,435,709	1,361,420	1,232,000	1,152,000
South Utah	*nil*	*nil*	.....	.....
United Verde*	2,900,000	3,000,000	.....	.....
Utah Copper Co	4,562,417	5,676,484	7,182,495	.....
Lake Superior*	20,400,000	18,300,000	17,500,000	19,000,000
Non-rep. mines*	8,250,000	7,750,000	7,500,000	.....
Total production	101,309,798	103,005,194	.....	.....
Imports, bars, etc.	22,797,099	28,761,087	.....	.....
Total blister	124,106,897	131,766,281	.....	.....
Imp. in ore and matte	8,149,728	10,385,662	.....	.....
Total American	132,255,625	142,151,943	.....	.....
Miami†	2,972,000	2,913,840	2,932,369	2,817,200
Brit. Col. Cos.:				
British Col. Copper	881,582	.....	.....	.....
Granby	1,852,896	.....	1,792,245	1,740,000
Mexican Cos.:				
Boleo†	2,315,040	2,480,240	2,658,880	2,535,680
Cananea	5,064,000	5,592,000	.....	4,880,000
Moctezuma	2,112,377	2,793,781	2,913,294	2,730,914
Other Foreign:				
Braden, Chile	1,028,000	910,000	1,484,000	1,178,000
Cape Cop., S. Africa	907,200	750,560	770,540	.....
Kyshtim, Russia	1,523,200	1,489,600	1,644,160	.....
Spassky, Russia	974,400	974,400	974,400	.....
Exports from				
Chile	4,816,000	7,392,000	6,752,000	5,824,000
Australia	10,752,000	9,856,000	9,744,000	5,512,000
Arrivals in Europe‡	12,976,320	16,363,200	17,689,280	8,509,760

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
II, 1912	116,035,809	56,228,368	63,148,096	66,280,643	154,851,200	221,131,843
III	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V	126,737,836	72,702,277	69,485,945	65,066,029	134,176,000	199,242,029
VI	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	.....	.....	.....	122,302,890	81,244,800	203,547,690

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Other Metals

Aluminum—The market is strong, especially for early deliveries. Prices are firmer, 27@27½c. per lb. being asked for No. 1 ingots, New York.

The latest London quotation for No. 1 ingots is £86@90 per long ton—equal to 18.69@19.56c. per lb.—according to size of order.

The Secretary of the Treasury has issued an order to the Collector of Customs at New York providing for a drawback on aluminum ingots manufactured by the United Aluminum Ingot Co., of New York, from imported scrap, cake, and oxide aluminum and clippings from imported sheet aluminum. The usual records and affidavits are required.

Antimony—The market is quiet and business is largely of a retail order. Prices are unchanged, at 9¼@9½c. per lb. for Cookson's 8⅞@9⅛c. for Hallett's; 8⅛@8⅜c. for Hungarian, Chinese and other outside brands.

Quicksilver—The market is rather quiet and prices are unsettled here. The New York quotation may be given at $39@40 per flask of 75 lb., with 59c. per lb. for small lots. San Francisco $40 for domestic orders and $37.50 for export. London price is £7 10s. per flask, with £7 5s. named from second hands.

Nickel—Shot, block and plaquettes are quoted at 40@45c. per lb., according to quality and size of order. Electrolytic nickel is 5c. per lb. higher.

Selenium—Producers of this metal quote large lots at $2.75@3.50 per lb., according to size of order; while as high as $4.50@5.50 is paid for retail lots.

Cadmium—The latest quotation from Germany is 725@750 marks per 100 kg. f.o.b. works in Silesia. This is equal to 78.27@80.97c. per lb. at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Mar. 15

The base price paid this week for 60% zinc ore was $48@49. The base price paid for 80% lead ore was $52@53 per ton.

SHIPMENTS WEEK ENDED MAR. 15

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	2,540,600	281,510	927,010
Year to date	34,521,950	1,519,140	11,797,400

Shipped during week to separating plants, 1,966,270 lb. zinc ore.

JOPLIN, MO.—Mar. 15

The zinc market weakened at the close, the low base offerings today being $2 under the low offering a week ago, putting the range for blende at $44@50, with $53 per ton the high mark. Calamine sold at $25@27 per ton of 40% zinc. The average of all grades of zinc is $45.26. Lead is unchanged and strong at a base of $53.50 per ton of 80% metal content, but the high price was $55.50, lower by 50c. Average all grades, $53.08 per ton.

SHIPMENTS, WEEK ENDED MARCH 5

	Blende	Calamine	Lead Ore	Value
Totals, week	10,846,270	1,466,050	1,948,740	$330,388
Eleven weeks	112,727,790	7,885,070	20,692,960	$3,453,980

Blende value, the week, $261,833; 11 weeks, $2,794,492.

Calamine value, the week, $16,880; 11 weeks, $113,682.

Lead value, the week, $51,675; 11 weeks, $545,806.

MONTHLY AVERAGE PRICES

Month	Zinc Ore						Lead Ore		
	Base Price			All Ores			All Ores		
	1911	1912	1913	1911	1912	1913	1911	1912	1913
January	$41.85	$44.90	$53.30	$40.55	$43.54	$52.22	$55.68	$58.92	$52.55
February	40.21	45.75	46.88	39.16	43.31	44.34	54.56	52.39	52.60
March	39.85	51.56	.....	38.45	49.25	.....	54.57	54.64	.....
April	38.88	52.00	.....	37.47	50.36	.....	56.37	54.18	.....
May	38.25	55.30	.....	36.79	53.27	.....	55.21	52.45	.....
June	40.50	55.88	.....	38.18	54.38	.....	56.49	55.01	.....
July	40.75	58.85	.....	38.36	56.59	.....	58.81	58.83	.....
August	42.50	55.13	.....	41.28	53.27	.....	60.74	57.04	.....
September	42.63	59.75	.....	41.29	57.07	.....	59.33	61.26	.....
October	42.38	57.00	.....	40.89	55.97	.....	54.72	63.22	.....
November	45.40	55.69	.....	43.25	53.98	.....	57.19	56.55	.....
December	44.13	54.63	.....	40.76	52.39	.....	62.03	52.42	.....
Year	$41.45	$53.87	.....	$39.90	$51.95	.....	$56.76	$56.41	.....

Note—Under the first three columns are given base prices for 60 per cent. zinc ore: the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

New Caledonia Ores—Exports of ores from New Caledonia for the year ended Dec. 31, as reported by the "Bulletin du Commerce," of Noumea, were 74,358 metric tons of nickel ore and 50,516 tons chrome ore. Exports of metals were 3625 tons nickel matte.

IRON TRADE REVIEW

NEW YORK—Mar. 19

Little that is new can be said of the iron trade. Specifications continue heavy and the mills are very busy, for the most part working up to capacity.

There is more inquiry for material, especially from manufacturers who are not well covered for second quarter. Inquiries for second-half material are also more frequent.

The new construction in progress in the Pittsburgh and Youngstown districts is expected to relieve the scarcity of steel. This construction will add about 170,000 tons a month to the make of openhearth steel. Nearly all of this will be ready by August or September.

Pig iron is a little more active. There are more inquiries, especially for basic iron, and another rush of orders is not unexpected for next month.

Foreign Trade of Austria-Hungary for the year 1912 is reported as follows, in metric tons:

	Exports	Imports	Excess
Iron and steel	148,382	357,290	Imp. 208,902
Machinery	33,214	139,886	Imp. 106,67
Total	181,596	497,176	Imp. 315,580
Total, 1911	256,354	314,049	Imp. 57,695

About 68% of the imports in 1912 was in pig iron and scrap.

PITTSBURGH—March 18

There has been no material change in the general prospects of the steel industry, which continue very favorable. There is more diversity in reports as to specifications received for steel products than there was, as some mills report specifications thus far this month at a rate exceeding that in February, while others are evidently receiving at a lower rate. On an average, specifications are probably fully as heavy as in February, and they exceed shipments, although these are easily at record rate. March is always a particularly good month for production. Through weather conditions, and perhaps also from inadequate labor supply, production is likely to show decreases after this month and through midsummer, though demand is not likely to show any material abatement. The matter of prices seems to be settled for months to come.

Pig Iron—The Westinghouse Machine Co.'s recent purchases of foundry iron were not only at record low prices on this movement, but represented very substantial declines from prices which had been nominally quoted as the market. Several parcels were bought, none at as high as $16.50, Valley, while it is claimed that one lot was secured at $16, Valley. For a short time in December the market was quotable at $18, but this was largely nominal, since no considerable tonnage was sold at anything like that price. Bessemer is quiet but firm. An early buying movement in steel making iron is still expected. The Jones & Laughlin Steel Co. yesterday blew in one Eliza furnace which had been out for repairs. We quote: No. 2 foundry, $16.50; basic, $16.10; bessemer, $17.25; forge, $16; malleable, $16.75; f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market continues quiet, with little demand, and occasional softness in prompt material. We continue to quote prompt and contract at $65, Baltimore.

Steel—The Youngstown Sheet & Tube Co. is offering a limited tonnage of steel for third quarter, against its new openhearth extension which is expected to be in operation by June. The market is still largely nominal, on account of very limited supplies, and we continue to quote billets at $29 and sheet bars and rods at $30, at maker's mill, Pittsburgh or Youngstown.

Sheets—Specifications on sheet contracts continue good, and fully equal to the current output, while new buying is relatively light, although perhaps somewhat better than in February. The mills are still losing time occasionally from shortage of steel but on the whole are doing well, with production practically at record rate. We quote: Blue annealed, 10 gage, 1.75c.; black, 28 gage, 2.35c.; galvanized, 28 gage, 3.50c.; painted corrugated, 2.55c.; galvanized corrugated, 3.55c., per pound.

IRON ORE

Owners of vessels are reported to be holding back a little from iron-ore contracts, believing that they can do better as wild boats later in the season. Preparations are being made for an early opening of navigation.

The railroads carrying iron ore from the Old Ranges have announced that a charge will be made for delivery and storage, in addition to the carrying charges to Lake ports. This charge will be 5c. per ton on all ore loaded on vessels within 10 days; for each additional day over 10, storage of 0.25c. per ton. The present carrying rates from the mines are 40c. to Ashland or Escanaba and 32c. to Marquette.

Average freights on iron ore on the Lakes for five years past are reported as below by the Cleveland "Marine Review," in cents per ton:

	Escanaba		Marquette		Duluth, etc.	
	Contract	Wild	Contract	Wild	Contract	Wild
1908	$0.50	$0.50	$0.60	$0.60	$0.65	$0.65
1909	0.50	0.52	0.60	0.61	0.65	0.66
1910	0.55	0.55	0.65	0.65	0.70	0.70
1911	0.45	0.45	0.55	0.55	0.60	0.60
1912	0.35	0.39	0.45	0.49	0.50	0.54

Charge for unloading iron ore at lower ports in 1912 was 10c. per ton. In the seasons 1909-1911 very little ore was carried by wild boats.

Exports of manganese ore from Russia for the year were 593,590 tons in 1911 and 941,673 in 1912; an increase of 348,083 tons. The larger exports in 1912 were 276,671 tons to Germany, 226,489 tons to Great Britain and 161,430 tons to Belgium. The United States took 91,533 tons.

COAL TRADE REVIEW

NEW YORK—Mar. 19

The bituminous trade in the West remains rather strong, owing to the steady demand for steam coal. Car service is better. The pressure for gas coal continues. The seaboard trade is steady and prices hold up well, while the discussion over yearly contracts has begun. Sellers are generally asking an advance over last year.

Anthracite trade is dead for the time being. Dealers will do nothing, in view of the approach of the April discounts. The mild weather has offset the smaller production, and the mines generally are curtailing work and making only moderate shipments.

Exports of Fuel from Germany in January included 2,386,249 tons coal; 7238 tons brown coal; 628,164 tons coke; 336,184 tons briquettes. The imports were 603,319 tons coal: 503,704 tons brown coal; 49,853 tons coke; 11,884 tons briquettes.

Coal Production in Germany in January was, in metric tons:

	1912	1913	Changes
Coal	14,565,606	16,536,115	I. 1,970,509
Brown coal	6,865,208	7,375,566	I. 510,358
Coke	2,340,366	2,724,871	I. 384,505
Briquettes	1,922,021	2,269,475	I. 347,454

Of the briquettes reported this year 1,771,187 tons were made from brown coal, or lignite.

CHEMICALS

NEW YORK—Mar. 19

General trade is a little less active, but is still on a fair scale.

Arsenic—Supplies continue good, but prices are a little firmer, as demand has been better. Quotations are $4.25@4.37½ per 100 lb. for white arsenic.

Copper Sulphate—Trade is rather quieter, but prices are unchanged at $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Nitrate of Soda—Trade is steady and quotations are firm at 2.62½c. per lb. for spot and April; 2.60c. for May; 2.57½c. for June; 2.55c. for July; 2.52½c. for August and later deliveries.

PETROLEUM

The total quantity of petroleum products exported from Roumania during 1912 amounted to 846,423 metric tons, against 677,196 during 1911, showing an increase of 169,227 tons, or of 25%. The larger exports were to England, France, Egypt and Austria.

Exports of mineral oils from the United States in February were 126,557,479 gal. For the two months ended Feb. 28, the total exports were 247,790,819 gal. in 1912, and 266,617,058 in 1913; an increase of 18,826,239 gal., or 7.6% this year.

Assessments

Company	Delinq	Sale	Amt.
Advance, Ida	Mar. 15	Apr 15	$0.003
Alta, Nev	Mar. 24	Apr. 14	0 05
Bell Ida	Mar. 12	Apr. 12	0.01
Blue Star, Wash	Mar. 7	.....	0.001
Black Horse, Ida	Mar. 8	Mar. 27	0.005
Caledonia, Nev	Apr. 9	Apr. 29	0.05
Challenge, Nev	Apr. 1	Apr. 22	0.05
Chollar, Nev	Mar. 31	Apr. 24	0.03
Coeur d'Alene Vulcan, Ida	Mar. 2	Mar. 22	0.005
Corbin Copper, Mont	.....	Apr. 22	0.50
Crown Point, Utah	Mar. 20	Apr. 15	0.0½
Gold M'ntain Champ. Utah	Mar. 4	Mar. 22	0.0½
Great Falls, Utah	Mar. 22	Apr. 22	0.0½
National Copper, Ida	.....	.....	0.01
Nicodemus, Ore	Mar. 14	.....	0.05
Overman, Nev	Mar. 18	Apr. 8	0.05
Pacific Quicksilver, Calif	Mar. 5	.....	0.03
Relonia M. & M., Utah	Mar. 6	Apr. 5	0.0½
Seg. Belcher, Nev	Apr. 8	Apr. 29	0.02
Sierra Nevada, Nev	Apr. 2	Apr. 23	0.100
Tar Baby, Utah	Mar. 10	Apr. 7	0.0g
Tintic Central, Utah	Mar. 11	Mar. 29	0.0½
Tonopah Gipsy Queen, Nev.	Mar. 31	May 5	0.01
Wabash, Utah	.....	Apr. 10	0.05

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59 043	61.642	24.081	27.190	28.357
March	52.745	58.375	.....	24.324	26.875	.....
April	53.325	59.207	.....	24.595	27.284	.....
May	53.308	60 880	.....	24.583	28 038	.....
June	53.043	61.290	.....	24.486	28 215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63 078	.....	24.209	29 088	.....
October	53.340	63.471	.....	24.594	29 299	.....
November	55.719	62.792	.....	25.649	29 012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62 893	65.519
March	14.698	.....	14.868	.....	65.884	.....
April	15 741	.....	15.930	.....	70.294	.....
May	16.031	.....	16 245	.....	72 352	.....
June	17 234	.....	17 443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78 670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	12.962	48.766	195.036	220.150
March	12.577	.....	192.619	.....
April	43.923	.....	200.513	.....
May	16.063	.....	208.830	.....
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4 321	4.327	4 171	15.597	17.114
February	4.026	4.325	3 946	4.175	15 738	16.550
March	4.073	.....	4.046	.....	15.997	.....
April	4 200	.....	4 118	.....	16 331	.....
May	4 194	.....	4 072	.....	16 509	.....
June	4 392	.....	4 321	.....	17 588	.....
July	4 720	.....	4.603	.....	18 544	.....
August	4 569	.....	4 452	.....	19 655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20 630	.....
November	4.615	.....	4.463	.....	18 193	.....
December	4 303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26 661	25.338
March	6.626	.....	6.476	.....	26.048	.....
April	6.633	.....	6 483	.....	25 644	.....
May	6.679	.....	6.529	.....	25.790	.....
June	6.877	.....	6 727	.....	25.763	.....
July	7.116	.....	6 966	.....	26 174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7 313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7 371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26 494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	.....	13.66	.....	14 10	.....
April	15.13	.....	13.90	.....	14.15	.....
May	15.14	.....	13.90	.....	14.12	.....
June	15.15	.....	14.11	.....	14.22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14.90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18 07	.....	17.09	.....	18 00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Mar. 18

Name of Comp.	Bid.
Acacia	.03
Cripple Cr'k Con	.01¼
C. K. & N	.13
Doctor Jack Pot	.07½
Elkton Con	.59⅝
El Paso	5.00
Findlay	.04½
Gold Dollar	.11¾
Gold Sovereign	‡.02½
Isabella	.11¾
Jack Pot	.06
Jennie Sample	.05
Lexington	‡.008
Moon Anchor	‡.005
Old Gold	.02
Mary McKinney	.64
Pharmacist	.01½
Portland	.98⅜
Vindicator	95
Work	‡.004

SALT LAKE Mar. 18

Name of Comp.	Bid.
Beck Tunnel	.06
Black Jack	.10½
Cedar Talisman	.01½
Colorado Mining	.12½
Columbus Con	.05
Crown Point	.02¾
Daly-Judge	6.35
Grand Central	.75
Iron Blossom	1.50
Little Bell	.35
Lower Mammoth	.03½
Mason Valley	6.50
May Day	.12½
Nevada Hills	1.07½
New York	‡.005
Prince Con	62
Silver King Coal'n	3.15
Sioux Con	.04½
Uncle Sam	.06¾
Yankee	.11

TORONTO Mar. 18

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.09½	Foley O'Brien	.38
Coniagas	7.50	Hollinger	16.75
T. & Hudson Bay	65.00	Imperial	.04
Timiskaming	.40	Jupiter	.45
Wettlaufer-Lor	.13	Pearl Lake	.65
Apex	.02½	Porcu. Gold	.25½
Crown Chartered	.01	Preston E. D	.04
Dobie	.15	Rea	.30
Dome	17.50	Swastika	.15½
Dome Exten	.12½	West Dome	.23

SAN FRANCISCO Mar. 18

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.01	Belmont	7.02½
Belcher	‡.30	Jim Butler	.88
Best & Belcher	.03	MacNamara	.20
Caledonia	1.15	Midway	.53
Challenge Con	‡.06	Mont.-Tonopah	1 75
Chollar	.01	North Star	.23
Confidence	.35	West End Con	1.40
Con. Virginia	.20	Atlanta	.17
Crown Point	‡.30	Booth	.06
Gould & Curry	.03	C.O.D. Con	.06
Hale & Norcross	.08	Comb. Frac	.06
Mexican	.72	Jumbo Extension	.27
Occidental	.70	Pitts.-Silver Peak	.57
Ophir	.17	Silver Pick	.07
Overman	‡.55	St. Ives	.30
Potosi	.02	Tramp Con	.01
Savage	‡.04	Argonaut	‡2.00
Sierra Nevada	.08	Bunker Hill	‡1.50
Union Con	.11	Central Eureka	‡.17
Yellow Jacket	.24	So. Eureka	‡2.50

N. Y. EXCH. Mar. 18

Name of Comp.	Clg.
Amalgamated	68¼
Am. Agri. Chem	53
Am.Sm.&Ref.,com	68
Am. Sm. & Ref., pf.	103
Am. Sm. Sec., pf. B	85
Anaconda	36⅛
Batopilas Min	1⅛
BethlehemSteelpf	69
Chino	38¼
Federal M. &S., pf.	33
Goldfield Con	2⅞
GreatNor.,ore,,ctf.	34
Guggen. Exp	44¾
Homestake	100
Inspiration Con	16
Miami Copper	22⅝
Nat'nalLead,com.	47⅛
National Lead, pf.	105⅛
Nev. Consol	16⅞
Phelps Dodge	‡200
Pittsburg Coal, pf.	81⅛
Ray Con	18⅛
RepublicI&S,com.	25
Republic I & S, pf.	85¼
SlossSheffi'd,com.	34⅛
Sloss Sheffield, pf.	90
Tennessee Copper	35
Utah Copper	51¼
U. S. Steel, com	59¾
U. S. Steel, pf.	107⅛
Va.Car. Chem., pf.	107¾

N. Y. CURB Mar. 18

Name of Comp.	Clg.
Barnes King	‡.97
Beaver Con	.39
Braden Copper	8⅝
B. C. Copper	3½
Buffalo Mines	2
Caledonia	‡.40
Con. Ariz. Sm	⅜
Davis-Daly	1¼
Diam'field-Daisy	.05
Ely Con	.12
Florence	.52
Giroux	3½
Gold Hill Con	‡¾
Greene Cananea	8
Greenwater	.04
Internat. S. & R	‡117
Kerr Lake	3
Keystone	‡2
La Rose	2¾
McKinley-Dar-Sa	2
Min. Co. of A. new	2¾
Motherlode Gold	‡.60
Nev. Utah M. & S	‡.01
Nipissing Mines	9¼
Ohio Copper	¾
Pacific Sm. & M	1
Puebla S. & R	2⅛
South Live Oak	‡2
South Utah M. &S	⅜
Standard Oil (Old)	‡1110
Stand'd Oil of N.J.	359
Stewart	1
Tonopah	5
Tonopah Ex	2
Tonopah Merger	.90
Tri-Bullion	
Tularosa	
Union Mines	‡
United Cop., pfd	8
Yukon Gold	3

LONDON Mar. 19

Name of Com.	Clg.
Camp Bird	£0 19s 10d
El Oro	0 16 2
Esperanza	1 7 10
Mexico Mines	6 15 0
Oriental Con	1 9 0
Oroville	0 6 9
Santa Gert'dis	1 4 9
Tomboy	1 4 9

BOSTON EXCH. Mar. 18

Name of Comp.	Clg.
Adventure	2½
Ahmeek	290
Algomah	1
Allouez	36½
Am. Zinc	28¾
Ariz. Com., ctfs	3¾
Bonanza	.40
Boston & Corbin	6¼
Butte & Balak	2
Calumet & Ariz	63
Calumet & Hecla	451
Centennial	14
Cliff	1½
Copper Range	44
Daly West	3½
East Butte	12
Franklin	6¾
Granby	57
Hancock	19¾
Hedley Gold	31
Helvetia	.25
Indiana	13
Island Cr'k, com	50
Island Cr'k, pfd	86
Isle Royale	24
Keweenaw	2
Lake	14⅛
La Salle	4
Mass	4¼
Michigan	1
Mohawk	49
New Arcadian	2⅜
New Idria Quick	5¼
North Butte	27
North Lake	1
Ojibway	2
Old Dominion	48
Osceola	88
Quincy	66
Shannon	10½
Shattuck-Ariz	23½
Superior	30
Superior & Bost	3¾
Tamarack	26
Trinity	4
Tuolumne	2⅞
U. S. Smelting	40¼
U. S. Smelt'g, pf	48¼
Utah Apex	1¾
Utah Con	9⅝
Victoria	1½
Winona	2¾
Wolverine	61
Wyandot	.96

BOSTON CURB Mar. 18

Name of Comp.	Last
Alaska Gold M	13½
Bingham Mines	4
Boston Ely	.60
Boswyocolo	‡.01
Butte Central	6
Cactus	07
Calaveras	2½
Chief Cons	1
Corbin	.72
Cortez	.35
Crown Reserve	3⅝
Eagle & Blue Bell	1
First Nat. Cop	1½
Majestic	.42
Mexican Metals	1
Moneta Porc	‡.06
Nevada-Douglas	2⅜
New Baltic	.80
Oneco	1½
Raven Copper	.15
Rhode Island Coal	‡.08
Smokey Dev	1½
S. W. Miami	3½
South Lake	6½
Trethewey	‡.42
United Verde Ext.	.65

‡Last quotation.